Green Bonds Programme
KENYA

PREPARED BY:

Strategic Business Advisors (Africa) Ltd
Business, Economics & Finance Consultants

STUDY SUPPORTED BY:

WWF

ASSESSMENT OF GREEN INVESTMENT OPPORTUNITIES IN THE AGRICULTURE, LIVESTOCK AND FORESTRY SECTOR IN KENYA

nairobi securities exchange
Sustainable Finance Initiative
KENYA BANKERS ASSOCIATION
Climate Bonds INITIATIVE
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Strategic Business Advisors (Africa) Ltd

Executive Director/Team Leader – John Kashangaki

Consultant – Wanja Getambu-Kiragu

EXECUTIVE SUMMARY

Introduction & Background

The research project "Assessment of Green Investment Opportunities in Kenya" was carried out in partnership between the Green Bonds Program Kenya and WWF Kenya. The project was funded by WWF Kenya and the research was conducted by Strategic Business Advisors (SBA) Africa. The program aspires to contribute to the national agenda by helping achieve Vision 2030, the Kenya Green Economy Strategy and Implementation Plan, as well as Kenya's climate change commitments as outlined in the National Policy on Climate Finance, the National Climate Change Act, the Climate Change Action Plan and the Nationally Determined Contributions under the Paris Climate Agreement.

The overall objective of the study is to quantify the investment opportunity for green investments in Kenya, to identify barriers and to propose solutions for creating bankable projects for the Green Bond.

Agriculture has been identified as a major source of GHG emissions second only to Electricity and Heat Production. [1]The European Environment Agency reports that between 2001 and 2011, global emissions from crop and livestock production grew by 14 per cent. This growth has been attributed to a rise in agricultural output because of increased global food demand as well as changes in food-consumption habits in certain developing countries due to rising incomes. According to the Kenya GHG emissions report, the year 2000 saw emissions by the agriculture sector reach 22,539 or approximately 23 million tons of carbon dioxide. This was against a total recorded emission of 54,955 or approximately 55 million tons of carbon dioxide. In 2010, emissions in agriculture had risen to 30 million tons of carbon dioxide out of 70 tons representing 43 per cent of total emissions. In 2015, emissions in agriculture again rose to 32 million tons of carbon dioxide out of 80 tons. The forecast for 2020 puts emissions in agriculture at 34 million tons out of 96 million tons by 2030.

Key Findings

Agriculture is a key driver of Kenya's economy contributing 30% of GDP and over 50% of employment. Key emission sources as well as climate mitigation and adaptation opportunities have been identified within the agriculture sector and have been selected as the focus areas for investment and financing opportunities. These sources include[2]:-

- Deforestation
- Livestock
- Agricultural Soils
- Increased Yields - improved inputs
- Disease Management – both livestock and crops improved pesticides
- Energy Use/Waste Management
- Irrigation and other Water Efficiency

[1] https://www.eea.europa.eu/signals/signals-2015/articles/agriculture-and-climate-change

[2] Based on review of climate smart investments in other countries as well as discussions with key informants

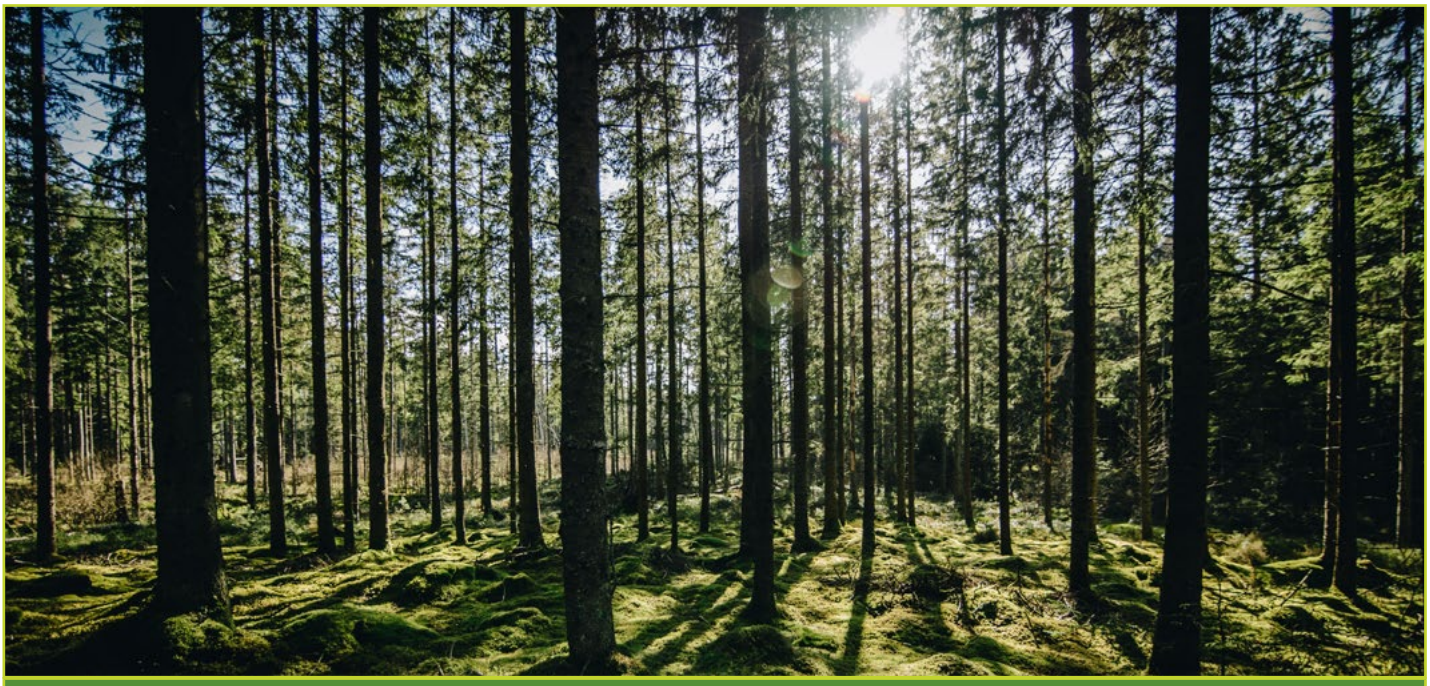
Immediate and Long-Term Financing Needs

Based on the opportunities identified the short- term investment opportunities are approximately $35 million dollars per year growing to over $180 million dollars per year in 5-10 years across the various subsectors in Agriculture. Immediate financing estimates for climate smart projects are about 3.5% of current bank financing of Agriculture. [3]These are conservative estimates that can grow significantly with targeted support to the sector. Within each of the categories identified there are significant opportunities for SMEs to invest or participate in the value chain.

Total

Immediate (next 1-2 years): $35.5 million

Medium to Long-Term (5-10 years) annual requirement: $182 million



Sub-sector: Forestry

Immediate (next 1-2 years): $2.5 million

Medium to Long-Term (5-10 years) annual requirement: $7 million

Opportunities identified for SME's:
Large opportunities to invest in tree nurseries and to provide tree management services

[3] Estimated total lending to agriculture in 2017 was about Kshs 100 billion or $1 billion (Central Bank 2018).

Sub-sector: Livestock

Immediate (next 1-2 years): $11 million

Medium to Long-Term (5-10 years) annual requirement: $75 million

Opportunities identified for SME's:

Opportunities for investing in hay farming as well as production of climate smart animal feed industry.

Significant investment opportunities to enter sustainable aquaculture - production of fingerlings, cage farming.

Sub-sector: Agro-Inputs

Immediate (next 1-2 years): $6 million

Medium to Long-Term (5-10 years) annual requirement: $50 million

Opportunities identified for SME's:

Some opportunities to manufacture and sell organic pesticides as well as produce improved seeds but for larger SME's.

Opportunities in the marketing and distribution of these products as well. DEMO farms, agrovets etc.

Sub-sector: Waste/Energy

Immediate (next 1-2 years): $13 million

Medium to Long-Term (5-10 years) annual requirement: $45 million

Opportunities identified for SME's:

Some opportunities for larger SMEs to invest in production and distribution of biogas and other organic fertilisers.

Sub-sector: Irrigation

Immediate (next 1-2 years): $3 million

Medium to Long-Term (5-10 years) annual requirement: $5 million

Opportunities identified for SME's:
Significant opportunities for smallholder investments in drip irrigation.

Key Challenges Identified to Growing the Portfolio Include:

- Penetrating the smallholder market – A key challenge in introducing climate smart interventions to smallholder farmers is convincing them to adopt to new practices. The capital required to provide education and extension services is significant and, in many cases, particularly for SME's not available. For processors and other larger players aggregating smallholders into viable commercial entities is also a challenge and very expensive.
- Initial capital required to start investments is a barrier for many new entrants; risk perception of the sector and long payback periods for some investments also limits access to capital.
- For some products, government subsidy impacts the investor potential – particularly the input markets.
- For some products, particularly waste management, access to consistent supply may limit the scale of the investment opportunity.
- Competing cheap imports limits growth of local production of some products like LPG and aquaculture.

Emerging from the Challenges, Key Recommendations Include:

- **Given the risk element of financing projects in this sector, a combination of different forms of funding – grant, equity, early stage and commercial bank funding – will be needed to grow investments in the sector.** This is already occurring in the Kenyan market – there are several impact and grant funds that have been set up specifically targeting climate smart investments in agriculture and other sectors. [4] There is no synergy however between different initiatives to achieve scale. This is recommended going forward.
- In line with the recommendation above, capital requirements for new market entrants is quite high and in many cases not available. **There is need for more support for business incubation and early stage funds to allow for more investment in this segment.** For the GBPK a possible entry point could be through existing funds that already have a track record and are looking to expand.[5]
- **Smallholder farmers need to receive much more funding to allow them to adopt new technologies at scale.** At present, limited funding is available through banks and microfinance institutions due to the risk perception and inability to ring fence cash flows. Effort needs to be made to provide risk sharing mechanisms to enhance scale. For microfinance institutions some may require additional capital as deposit mobilisation is still low. [6] In addition, support to aggregators and other value chain players like co-operatives can help to increase access to finance. This funding needs to be supported by public investments in extension that will make smallholders more aware of the benefits of climate smart technologies.
- To open-up agricultural input markets since government is a key player, **government interventions need to be reduced or aligned more closely to private sector requirements** for growth.
- **Channel funds raised through green bond issuance to professional fund management vehicles** that thereafter seek and specifically invest in green investments.
- **Provide incentives for companies that invest in green bonds.** These could include tax incentives or recognition on national platforms.

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[4] See for example Kenya Climate Change Venture Fund established with the support of the World Bank. The African Enterprise Challenge Fund has been operating a climate change window for several years and has provided repayable grants to several companies (see examples in the annex).

[5] The National Enterprise Development Fund supported by GOK and SIDA is actively involved in incubation and is looking for scale up – KCVCF and AECF could also be potential partners.

[6] Several pilot projects including one funded by IFAD supporting growth of agricultural finance through MFIs identified access to capital as a constraint for MFIs.

1. INTRODUCTION

1.1 Background

The research project "Assessment of Green Investment Opportunities in Kenya" was carried out in partnership between the Green Bonds Program Kenya and WWF Kenya. The project was funded by WWF Kenya and the research was conducted by Strategic Business Advisors (SBA) Africa.

The Green Bond Program – Kenya is brought together by Kenya Bankers Association (KBA), Nairobi Securities Exchange (NSE), Climate Bonds Initiative (CBI), Sustainable Finance Initiative (SFI), Financial Sector Deepening Africa (FSD Africa) and FMO, the Dutch Development Bank. The Green Bonds Programme Kenya is endorsed by the Central Bank of Kenya (CBK), Capital Markets Authority (CMA) and the National Treasury. The program aims to facilitate capital flows into green investments to support sustainable economic growth in Kenya through the following work steams:

- Research the potential of green bond issuance in Kenya;
- Develop a pipeline of green investments and engage with investors;
- Support demonstration green bond issuance from leading banks and corporates;
- Promote green Islamic finance;
- Develop a pool of Kenya-based licensed verifiers;
- Develop of a pooled bond facility that would allow smaller banks and corporates to also take advantage of wholesale debt capital markets; and
- Develop Kenya's Green Bond Market and build local capacity to catalyse similar programs across EAC.

The program aspires to contribute to the national agenda by helping achieve Vision 2030, the Kenya Green Economy Strategy and Implementation Plan, as well as Kenya's climate change commitments as outlined in the National Policy on Climate Finance, the National Climate Change Act, the Climate Change Action Plan and the Nationally Determined Contributions under the Paris Climate Agreement.

WWF-Global is one of the largest conservation organizations in the world. WWF-Kenya (WWF-K) implements programs and projects that contribute to providing an enabling environment for the achievement of sustainable natural resource management. It is considering this that WWF Kenya through this project, supported the Kenya Green Bond Program to understand the existing and estimated future investment potential and financing demand for green investment projects in Kenya.

1.2 The Green Investment Opportunity

Arguably there has never been a better time to invest in green, sustainable and climate smart solutions. The cost of clean technologies has fallen dramatically, globally governments are embracing policies that encourage climate investment, and the Paris Agreement has galvanized support for measures that keep global warming under two degrees Celsius.

A dramatic drop in the price of clean technologies and the rise of smart policies are driving businesses to climate-smart investments. [7]The International Renewable Energy Agency reported that by the end of 2017, the global renewable energy generation capacity had increased by 167 GW to 2,179GW globally. Global energy-efficiency potential is large and growing – governments and business invest more than $300 billion each year to improve the efficiency of power grids, transport, industry, and buildings. The global green buildings market continues to double in size every three years. Climate-smart agriculture is also a growing private sector opportunity, as companies seek to increase crop resilience and food productivity, as well as their profits.

The growth in greenhouse-gas emissions is expected to come mainly from emerging markets – which require $4 trillion per year to build and maintain infrastructure. How rapidly growing middle-income nations respond to their infrastructure needs will directly affect whether we can achieve the promise of the Paris Agreement. The good news is that growing economies can invest in new, climate-resilient infrastructure and offset higher upfront costs through efficiency gains and fuel savings.

Companies are also increasingly recognizing the need to ensure that their operations are resilient against supply chain disruptions and other effects of climate change. As a result, forward-looking businesses are moving quickly to climate-smart investments because it is good for the bottom line. Wall Street firms like Morgan Stanley report that investing in sustainability usually meets, and often exceeds, the performance of comparable traditional investments[8].

However, there are also barriers that may slow down the green pipeline and investment growth. For example, the global annual survey of the clean energy sectors by the International Energy Agency[9], concludes that transformation towards a clean energy system is not in line with stated international policy goals. Many technology areas suffer from a lack of policy support, and this impedes their scaled-up deployment.

Furthermore, while some sectors —notably renewable energy—have good investment forecasts in a global context, there is no such forecast for Kenya and there are also limited data and forecasts in areas such as climate-smart agriculture and forestry, energy efficiency, transportation and waste.

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[7] http://www.irena.org/newsroom/pressreleases/2018/Apr/Global-Renewable-Generation-Continues-its-Strong-Growth-New-IRENA-Capacity-Data-Shows

[8] Morgan Stanley Institute for Sustainable Investing (2015), Sustainable Reality: Understanding the Performance of Sustainable Investment Strategies, access at

[9] International Energy Agency (2017). The Annual Tracking Clean Energy Progress (TCEP) report of the Energy Technology Perspectives 2017

1.3 Objective of the Study

The overall objective of the study is to quantify the investment opportunity for green investments in Kenya, to identify barriers and to propose solutions for creating bankable projects.

The outcomes of this exercise as will be seen in this report have provided a clear indication of the space for green investments in Kenya. It is important to note that green investments refer to not only investments in opportunities that contribute to mitigation to climate change, but also other issues as have been identified under the Sustainable Development Goals as having direct relevance to the Green Bonds Principles and the Climate Bond Standards[10]. These include; pollution prevention, terrestrial and aquatic biodiversity conservation and food security. The mapping table of green bonds principles to SDGs is found in the annex of this report. As a result of a prioritization exercise conducted in the study, the report has focussed on three key sectors: -

1. Agriculture 2. Transport 3. Manufacturing

1.4 Methodology

To undertake the study, and to identify and size investment opportunities, the SBA team used multiple approaches that included:

- Interviews with key informants working in relevant capacities – commercial bankers, fund managers, development finance institutions, relevant donor funded programmes, private companies in the sector, NGOs and some Government representatives – to understand sector dynamics and opportunities[11];
- Review of relevant literature – to understand performance of the sector as well as to identify global best practice and investment trends for climate smart projects. Also looked extensively at online sources of data on existing financing of climate smart projects in Kenya by various funds;
- Developing list of potential investment opportunities identified from different sources;
- For each investment identifying the market size of the opportunity and growth potential using either direct data source or proxies eg. For organic fertiliser estimated size of entire fertiliser market in Kenya using data available; – through interviews, discussions with players in the sector like key buyers able to estimate that organic fertiliser market share is less than 5% of total.

[10] file:///C:/Users/Ben/Downloads/Green-Bond-Principles---June-2018-140618-WEB.pdf
[11] See list of persons met in Annex 3
[12] For example, Central Bank publishes data on lending to different sectors in the economy; lending to agriculture is about 5% of gross loans, manufacturing 12% and transport 7%.

- Based on an estimate of market size and growth estimates, estimate current and future financing potential using understanding of the sector, the size of investment needs and existing financing available. Each investment is analysed independently using the information available and data available on financing on different sectors[12]. Should be noted that the investment sizes are conservative estimates subject to more detailed market studies for each investment opportunity.
- Key findings were presented to an industry stakeholder group organised by KEPSA and comments received incorporated into the final report.

1.5 Structure of the Report

This report focuses on the agricultural sector. The structure of the report is informed by the objective and scope of the study. The report is structured as follows: -

- Overview of the Sector
- The Case for Sustainable Development in the Agriculture Sector Investment and Financing Opportunities in Agriculture
    - Key Investment Areas / Type pf Projects
    - Size of the Opportunity / Demand
    - Potential Risks (incl. Credit Risks) and barriers
- Summary of investment pipeline
- Conclusions

2. AGRICULTURE

2.1 Overview of Agriculture in Kenya

Agriculture remains the backbone of the Kenyan economy with over half of the population engaged in the sector. The agriculture sector in Kenya is comprised of three sub-sectors: Crops; Livestock; and Fisheries. The crop sub-sector is further divided into three sub-sectors: Industrial crops; Horticulture; and Food Crops.

2.1.1 Performance of the Sector

Economic Survey of 2018 reports agriculture as having contributed the highest wage employment with 15.5 per cent ahead of manufacturing at 12.8 per cent. Further, the sector posted a GDP of Kshs. 2,442 trillion with the next sector, manufacturing posting less than half the value at Kshs. 648 billion. The recorded marketed agricultural production at current prices (in Kshs Million), 2015 -2017 is presented below: -

Table 1: Agricultural production at current prices (kshs million)

CROPS	2015	2016	2017
Cereals (Maize, Wheat etc.)	24,192.7	23,185.4	19,726.9
Horticulture (Flowers, Vegetables and Fruit)	90,438.8	101,513.5	115,322.8
Temporary Industrial Crops (Sugar-cane, Pyre-thrum, Cotton etc.)	23,964.9	25,729.6	21,850.0
Permanent Industrial Crops (Coffee, Tea, Sisal)	134,060.8	137,469.1	154,420.9
Total	**272,657.3**	**287,897.7**	**311,320.6**
LIVESTOCK AND PRODUCTS			
Cattle and Calves	66,216.7	84,701.2	93,630.2
Goats and Sheep	4,854.7	5,767.4	6,782.4
Milk	21,205.4	23,020.1	20,878.2
Chicken and Eggs	6,005.9	8,788.4	10,674.8
Others	2,562.1	3,124.9	3,634.9
Total	**100,844.7**	**125,401.9**	**135,600.5**

Source: Economic Survey, Central Bureau of Statistics, 2018

As seen in the table above, industrial crops have the highest earning potential closely followed by horticulture. In the livestock sub-sector, cattle and calves contribute the highest in terms of earnings over other livestock.

Agriculture in Kenya is primarily rain-fed and small scale. The land sizes are mainly between 0.3 to 3 hectares. These small holder farmers contribute approximately 75% of total agricultural output of rain fed agricultural land. Large plantations and ranches are mainly government owned or owned by private ranching groups and plantation companies. These establishments largely employ irrigation and modern farming and ranching techniques.

[13]The livestock sub-sector in Kenya contributes approximately 12 per cent of the GDP while employing approximately 50 per cent of the national agricultural workforce and 90 per cent of the total workforce in arid and semi-arid lands.

Food supply in Kenya has been heavily dependent on imports. Every year Kenya imports between 10% and 40% of its maize, depending on the annual production (Short et al., 2013).

These stagnations and declines in cereal yields have followed the trends in the Sub-Saharan Africa (SSA) region. These have stagnated at slightly above 1 ton per hectare, whereas in other low-income countries around the world agricultural productivity is at 2 ton/ha/yr.; the world average is about 3.5 tons/ha/yr. The total productivity in SSA has grown by only about 50% in the last 25 years. The main challenges to this productivity in the region include prolonged droughts, high cost of inputs such as fertilizer, fluctuating market prices and attacks from pests and diseases.

2.1.2 The Green Economy Strategy and Implementation Plan

The Green Economy Strategy and Implementation Plan (GESIP) was developed because of the second Medium Term Plan (MTP II) 2013 -2017 that prioritized the development of a National Green Economy Strategy. Further, a Green Economy Assessment Report of 2014 confirmed that Kenya wold derive great benefit from transforming into a green economy. The Ministry of Environment and Natural Resources led the effort of formulating the GESIP through a Steering Committee representative of government sectors, civil society and development partners.

GESIP identifies five thematic areas to guide Kenya's transition to higher green growth, cleaner environment and higher productivity. These are: -

- **Sustainable Infrastructure** – Relates to designing, building and operating of the energy and infrastructure elements.
- **Building Resilience** - Strengthen the resilience of economic, social and environmental systems to the adverse effects of external shock.
- **Sustainable Natural Resources Management** – Identify drivers of natural resources, change and provide support from green and eco-friendly technologies, related research and innovation activities.
- **Resource Efficiency** – The realization of higher outputs with less natural resources whereby the economic value will be increased through high Total Factor Productivity (TFP).
- **Social Inclusion and Sustainable Livelihood** - Education and training to inculcate the Green Economy at all levels of education. Emphasis for GESIP is on re-orientation, education and training.

[13] http://www.kenyamarkets.org/press/cattle-population-in-decline-in-asals/

GESIP is also guided by 6 principles, these are Sustainable Consumption and Production (SCP); Equity and Social Inclusion; Resource Efficiency; Polluter-Pays-Principle; Precautionary Principle and Good Governance.

Kenya's Intended Nationally Determined Contribution (INDC) commits to reducing GHG emissions by 30% (143 MtCO2e) relative to business as usual levels by 2030. In addition, key targets include:

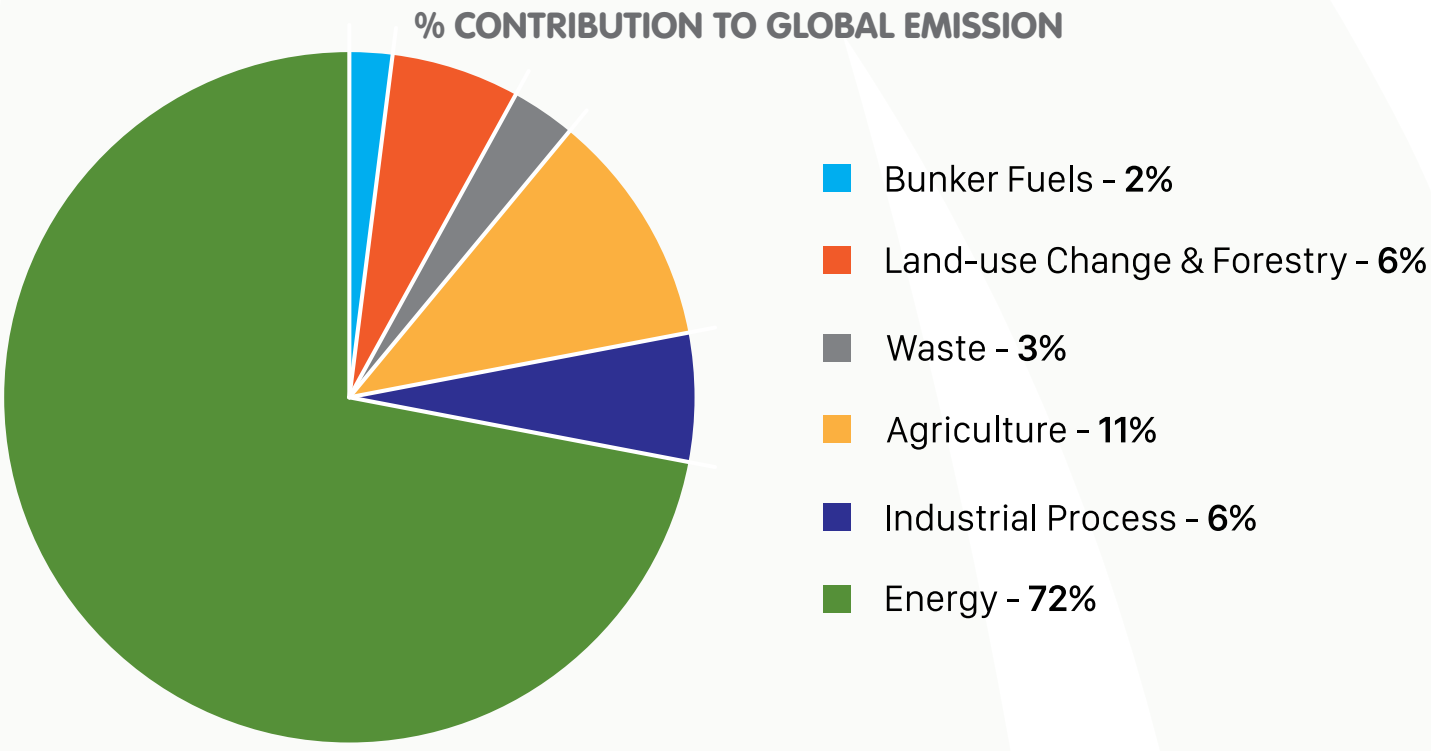
- 10% land area covered by trees
- Reach 20GW power capacity by 2030 – 51% renewable
- Reach 100% electrification by 2020

2.2 The Case for Sustainable Development in the Agriculture Sector

Agriculture has been identified as a major source of GHG emissions second only to Electricity and Heat Production. The European [14]Environment Agency reports that between 2001 and 2011, global emissions from crop and livestock production grew by 14 per cent. This growth has been attributed to a rise in agricultural output because of increased global food demand as well as changes in food-consumption habits in certain developing countries due to rising incomes.

Globally, agriculture remains a key contributor to GHG emissions at 11 per cent coming second after energy related emissions. The chart below shows the percentage contribution to GHG emissions by different man-made sources.

Figure 1: Sector Percentage Contribution to Global Emissions



Source:[15] Climate Analysis Indicators Tool (World Resources Institute, 2017).

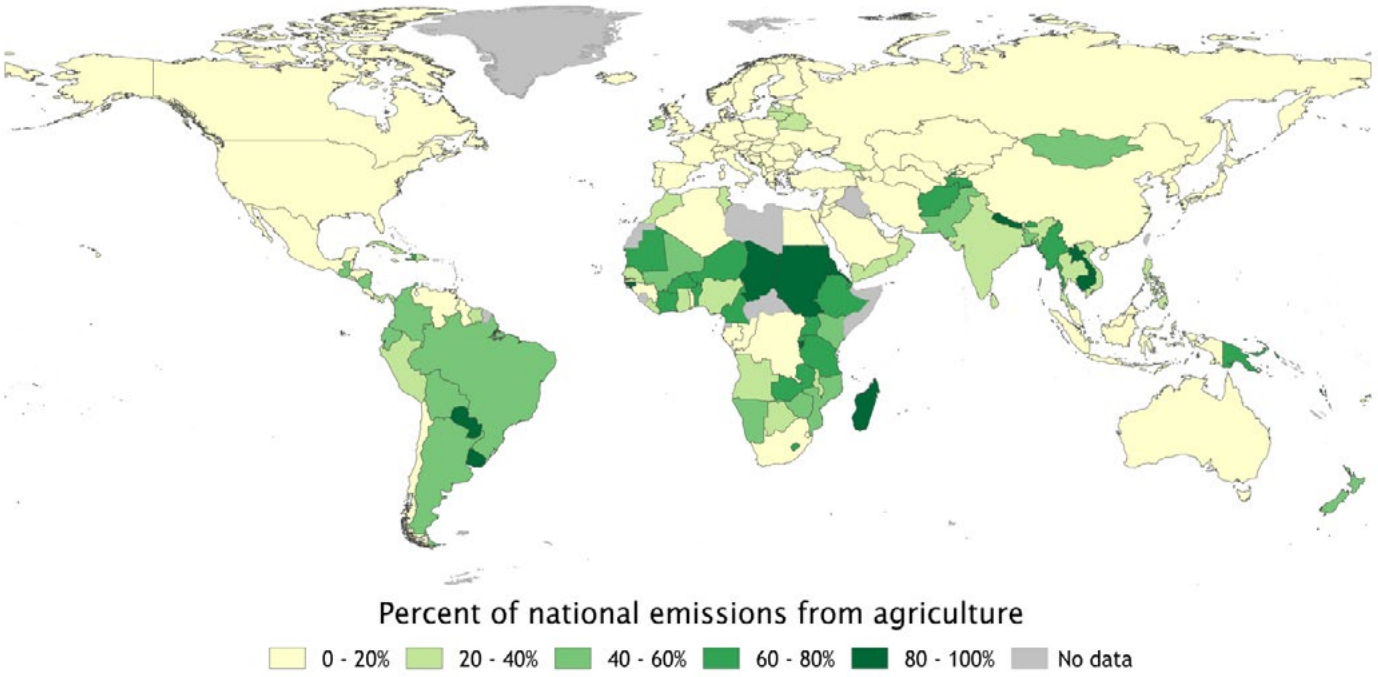
The World Resources Institute reports that as at 2011 the 10 countries with the largest agricultural emissions were (in descending order): China, Brazil, United States, India, Indonesia, Russian Federation, Democratic Republic of Congo, Argentina, Myanmar, and Pakistan. These countries contributed 51 percent of the total global agricultural emissions.

According to CGIAR (2015)[16] agriculture contributes over 50% of the emissions in 42 countries around the world and more than 20% of the emissions in 91 countries globally. The analysis further shows that 39% of global emissions from agriculture originate from only four countries including China, India, Brazil and the USA.

Projections by the Institute show that the growth in agricultural emissions will be greatest in Asia and Sub-Saharan Africa because of increase in the overall food demand. These regions alone will command a two-thirds of this expected increase. Another cause of increased overall agricultural emissions will be the growth in the production of vegetable oils and animal products, these are products whose origination and production have high levels of GHG emission.

Africa has generally lower emission levels in comparison with other regions around the world. However, agriculture as a sector contributes a large percentage of the total emissions in most African countries as shown in the diagram below.

Figure 2: Agriculture's Contribution to Total National Emissions

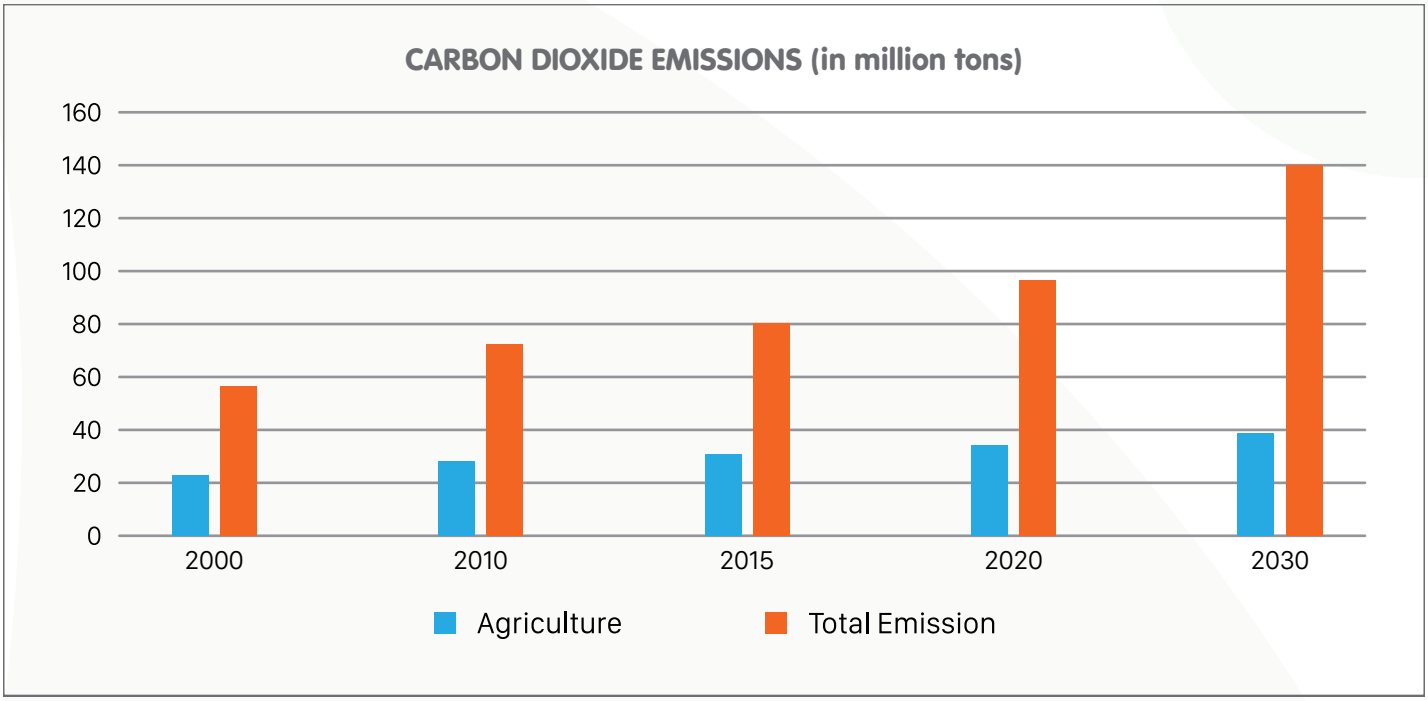


[14] https://www.eea.europa.eu/signals/signals-2015/articles/agriculture-and-climate-change
[15] https://www.c2es.org/content/international-emissions/
[16] https://cgspace.cgiar.org/rest/bitstreams/61660/retrieve

According to the Kenya GHG emissions report, the year 2000 saw emissions by the agriculture sector reach 22,539 or approximately 23 million tons of carbon dioxide. This was against a total recorded emission of 54,955 or approximately 55 million tons of carbon dioxide.

In 2010, emissions in agriculture had risen to 30 million tons of carbon dioxide out of 70 tons representing 43 per cent of total emissions. In 2015, emissions in agriculture again rose to 32 million tons of carbon dioxide out of 80 tons.

Figure 3: Carbon Dioxide Emissions in Agriculture in Kenya[17]



Source: NEMA (2015)

The forecast for 2020 puts emissions in agriculture at 34 million tons out of 96 million tons. By 2030, that number is expected to increase once more to 39 million tons against a total of 142 million tons.

Projections show that the mean annual temperatures in the country are expected to increase by 1-2.8°C by the 2060s, and 1.3-4.5°C by the 2090s (IPCC, 2007). This will be accompanied by an increase in mean annual rainfall by up to 48%, with the increase in the total rainfall greatest from October to December while the proportional change is largest in January and February. The regional variation within Kenya means that rainfall increases are expected to be concentrated from the Lake Victoria region to the central highlands east of the Rift Valley. The eastern and northern arid and semi-arid lands (ASAL) are expected to see an overall decrease in precipitation due to climate change (Ojwang' et al., 2010). The climate projection for the ASAL of Kenya may include longer and more frequent dry periods interspersed with intense but shorter and unpredictable periods of rainfall. Such weather patterns are likely to deplete water and pasture resources, leading to natural resource scarcity (GoK, 2007).

[17] https://unfccc.int/resource/docs/natc/kennc2es.pdf

Table 2: Summary of Impact and opportunities for Mitigation in Kenya

Current Situation
Farming in the country is largely small-scale, with 75 per cent of total agricultural output produced: • on rain-fed farms • Inherently high risk of the sector – output significantly affected by climate change/ extreme weather changes • High cost of inputs; low quality planning material in some cases • Post-harvest losses • Poor infrastructure affecting transportation of produce • Poor/ inefficient agricultural practices resulting in losses
Proposed Initiatives
• Promotion and dissemination of sustainable practices • Promotion of ecologically-sound farming practices, such as efficient use of water, extensive use of organic and natural soil nutrients, optimal tillage, integrated pest control and agroforestry. • Supporting green agricultural practices, such as organic farming, fish farming and post-harvest loss reduction
Expected Outcomes
• Increased productivity in the long run • Average agricultural yield under the green economy investment scenario would exceed that of the BAU investment scenario by about 15% by 2030. • Enhanced job creation, nutrition and food security. This would have positive effects on the manufacturing sector as well which heavily relies on the agricultural sector for supply of raw material.

3. INVESTMENT AND FINANCING OPPORTUNITIES IN AGRICULTURE

Key emission sources as well as climate mitigation and adaptation opportunities have been identified within the agriculture sector and have been selected as the focus areas for investment and financing opportunities. These sources include[18]:-

- Deforestation
- Livestock
- Agricultural Soils
- Increased yields - improved inputs
- Disease management – both livestock and crops improved pesticides
- Energy Use/waste management
- Irrigation and other water efficiency

3.1 Deforestation

Clearing of forests to make way for farm and pasture land has been reported to contribute approximately 10.3[19] per cent of global GHG emissions. The impact happens where the forests are decreased and therefore the capacity to absorb CO_2 is equally reduced. The earth's lungs are depleted and therefore the ability of the earth to breathe effectively.

The key investment area to counter the effects of deforestation and land use change is afforestation and reforestation. Afforestation is the establishment of tree cover where there previously was none while reforestation returns tree cover where trees were cut down. The objective of both actions is to establish and re-establish the earth's ability to absorb carbon dioxide. Also, enhancing water resilience through the protection of water towers and establishing more stable and favourable micro-climate i.e. cooler temperatures and more rains, the more carbon dioxide the earth can absorb, the less greenhouse effect experienced on earth.[20]Kenya is aiming for a 15 per cent forest cover by the year 2022. For this to be achieved, the National Environment Management Authority envisages the planting of 235 million seedlings.

3.1.1 Key Investment Areas/Type of Projects – Afforestation

Table below highlights investment opportunities under deforestation. Key areas identified include tree nurseries and management services for tree plantations.

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[18] Based on review of climate smart investments in other countries as well as discussions with key informants
[19] https://www.allianz.com/en/about_us/open-knowledge/topics/environment/articles/140912-fifteen-sources-of-greenhouse-gases.html/#!m9e9f7f0d-1392-4218-9048-7761c372a361
[20] https://www.capitalfm.co.ke/news/2018/03/kenya-aims-15pc-forest-cover-2022/
[21] https://www.standardmedia.co.ke/article/2000149112/seed-money-for-lucrative-tree-growing-trade
[22] Assuming an average cost of $1 per seedling the market size is as high as $100 million annually
[23] https://www.nation.co.ke/business/seedsofgold/Why-not-grow-your-money-on-trees/2301238-2583948-h243xc/index.html

Table 3: Investment Opportunities under Deforestation

Type of Project: Tree Nurseries (Sale of Tree Seedlings)

Size of Opportunity/Demand

In Kenya, tree seedlings range from a price of Kshs. 15 (USD 0.15) per seedling to as high as Kshs. 1,000 (USD 10). [21]According to the Kenya Forest Service, there is a growing local market of 100 million tree seedlings annually. At prices from USD 0.15, the market is at the lowest generating a value of USD 15 million annually to tree seedling sellers.[22] In addition to the 100 million tree seedlings annually, as reported, there is a national plan to plant over 235 million trees by 2022.

Potential Risks /Barriers

The main risk in financing nurseries is the risk of loss of seedlings due to causes such as disease.

Finance Demand

Demand for financing in this area is likely to increase over the short and medium term as more entrepreneurs seek to participate in this business. The attraction for this type of project is mainly the low entry barriers including low initial investment costs. Another attraction is the increased demand for trees for use in the furniture industry and as electric poles. This has created a growing market for tree seedling buyers.
As many are greenfield projects estimate size of financing demand to be about 10% of market size ($1.5 million per year growing to $5 million per year in 5 years.

Type of Project: Management Services for Tree Plantations

Size of Opportunity/Demand

Planting and maintenance of tree plantations is another service offered by various companies. A company like Goldens Cape Tree Africa charges Kshs. 10 (USD 0.1) to plant a tree. The rationale is that a tree planted the wrong way will not grow and for an extra USD 0.1 the company will plant the trees, and should the tree die, the company will replace the seed free of charge. Again, with the annual market of seedlings at 100 million, assuming a 10-20% market penetration the market opportunity is $1 -$2 million per year at the lower end.

Potential Risks /Barriers

The main risk in financing management services is that the success of the service is reliant upon properly set up systems and processes of managing the plantations as well as well trained and skilled manpower.

Finance Demand

Demand for financing in this area is likely to increase over the medium to long-term as more investors invest in trees with the objective of selling them as poles or furniture. [23]The proprietor of Green Kenya, Mr. Jacktone Kube, invested USD 3000 to buy seeds and prepare the farm where he would host the seedlings and plant some trees. Green Kenya has planted 4,500 trees on three and a half acres, 1000 of which are mature eucalyptus trees ready for sale. Each tree sells for between Kshs. 3,000 and Kshs. 5,000 depending on the size.
Being a service industry financing needs estimated to be quite low $500,000 - $1 million per year growing to about $2 million per year in five years.

3.2 Livestock and Fisheries

[24]Enteric fermentation is a digestion process where microbes in the rumen breakdown the consumed feed, a process which produces methane as a by-product. Belching is the main process by which this methane is released into the atmosphere by the ruminant animals. Beef cattle are reported to be the largest contributor of enteric methane. Beef cattle produce 107 to 300 g while sheep produce 17.8 to 39.3 g CH4/day. In the US, beef cattle are producing approximately 100 million metric tons of carbon dioxide equivalents annually. This is three times that of dairy cattle and over 50 times greater than pigs. This enteric methane is responsible for 15 per cent of global warming. The opportunities presented below relate specifically to reduction in GHG emissions.

a. **Feeds:** Production of methane by livestock can be reduced. One way is through offering the right feeds. Cereal – based diets, high in starch produce less methane per unit of feed consumed than forage-based feed. Further still, emissions are higher when the quality of forage is poor thus forage quality is key in reduction of emission. Feeding cattle on cereal-based feed results in lower GHG emissions.

b. **Mineral Supplements:** Lack of mineral supplements has also been identified as a source of increased emissions in livestock. There are seven minerals that are essential to livestock as they are required in relatively large amounts. These include calcium, phosphorus, potassium, sodium, chlorine, sulphur and magnesium. Other minerals like iron, iodine, copper, mangnesium, zinc, cobalt, selenium and chromium are also required but in trace amounts. Pastures and feeds in Kenya contain sufficient amounts of the minerals for most ruminants; however, during conditions such as drought, calcium and sodium deficiencies are common. Several parts of the central and rift valley provinces are also calcium deficient. There are methane-reducing feed additives and supplements that inhibit methanogens in the rumen and thus reduce enteric methane emissions. Synthetic chemicals exist however these are not recommended. Natural supplements such as seaweed are used. Seaweed reportedly fed at 3 per cent of the diet resulted in up to 80 per cent reduction in methane emissions from cattle.

c. **Fats and Oils:** Including fats and oil to ruminant diets have been identified as possible methods to reduce methane production by livestock. These fats and oils, reduce fibre digestion, lower feed intake and suppress the microorganisms that produce methane. Canola, coconut, soybean, sunflower, fish/sunflower oil and flaxseed oil are some of the oils fed to livestock. Studies have shown that coconut oil can reduce methane production by up to 70%. It is important to note however, that different fats and oils will affect the microbial population in different ways and therefore there may be different levels of reduction in methane production depending on the specific fats or oils used.

d. **Breeds:** Selection of animal breeds that consume less feed and shorter retention time of digested material in the rumen is another method that is utilized to reduce methane emissions. Scientists are also working on creating breeds that release gas less. It is important that such breeds through agencies such as the Kenya Agriculture and Livestock Research Organization (KALRO) are researched on to confirm suitability for the Kenyan environment. However, it is also important for research entities in Kenya such as KALRO and the International Livestock Research Institute (ILRI) to undertake their own research and development of such breeds.

[24] https://aglifesciences.tamu.edu/baen/wp-content/uploads/sites/24/2017/01/Contribution-of-Greenhouse-Gas-Emissions.-Animal-Agriculture-in-Perspective.pdf

3.2.1 Key Investment Areas / Type of Projects -Livestock and Fisheries

Table 4: Investment Opportunities Identified in Livestock and Fisheries

Type of Project: Hydroponics

Size of Opportunity/Demand

The State Department of Livestock in Kenya estimated the demand for feeds and supplements in 2014 at about 650,000 tons over double the demand in 2008 when it stood at 300,000 tons. Hydroponics entails the growing of fodder without soil but in water for a maximum of 6 days. [26]Hydroponics supports production of fodder in small spaces accessible to all farmers from smallholder farmers to ranchers. It is important to note that hydroponic fodder may not be as nutritious to ruminants as feeds such as grains, however, in semi-arid and arid areas, the security of feed availability through hydroponics is critical.

Potential Risks /Barriers

The main risk in financing hydroponics is the management of the loan portfolio as the main borrowers would be small scale farmers.

Finance Demand[25]

Demand for financing in this area is likely to increase over the short and medium term as more entrepreneurs seek to adopt this low-cost source of fodder. Cost of regular feed runs to approximately Kshs. 600 (USD 6) per cow per day against the cost of hydroponic fodder of Kshs. 75 (USD 0.75).

Assuming a growth from 1% to 5% market penetration over the next five years the annual opportunity is estimated at $4 million growing to $20 million per year in five years.

Type of Project: Hay Production

Size of Opportunity/Demand

Droughts incidences are on the increase as a result of climate change. Farmers who rely on grazing their livestock have found themselves with little pasture. The growing and baling of hay means access to sufficient fodder in the dry season. Hay is grown and stored and available throughout the year. [27]The business of growing hay provides two opportunities, the sale of seeds (e.g. Boma Rhodes seeds) and sale of hay. From 5 kg of seeds, a seed growing farmer may harvest up to 60 Kg which is sold for approximately Kshs. 333 per kg. An acre of Boma Rhodes harvests 100 to 120 bales. Each bale is sold for between Kshs. 150 and Kshs. 250. One hay farmer speaks of having invested Kshs. 800,000 and having a current farm of worth Kshs 25 million with investment in tractors, bailers and harvesters

[25] SBA estimates based on the size of the market and our assessment on potential based on literature review and key informants' assessment of existing market penetration and potential demand going forward.
[26] Using average cost of feed to be about $30 for 50 kg bag, total size of market is approximately $400 million dollars annually.
[27] https://www.nation.co.ke/business/seedsofgold/Hay-growing-fodder-is-good-business/2301238-2774360-paha4n/index.html

Potential Risks /Barriers

The main risk in investing in a hay business is the potential for loss where there is a failed harvest. This can be mitigated through first ensuring the correct seed and further close management of the crop and linkage to reliable markets or contracts with large livestock farms.

Many smallholder farmers unaware of economic benefit hence adoption rates are not optimal.

Finance Demand

Demand for financing in this area is likely to increase over the short and medium term as more livestock farmers seek this as a source of fodder for their animals but also as a business. Climate change and persistent droughts will sustain demand for this alternative to grazing.

Overall feed market size is $400 million so opportunity is large – financing demand is likely to grow gradually from about $4 million to $20 million in five years

Type of Project: Research and Product Development

Size of Opportunity/Demand

There is opportunity to undertake research and identify or develop products such as mineral supplements for the livestock sub-sector as well as introduce new breeds that will reduce GHG emissions from livestock and more specifically ruminants. In New Zealand, AgResearch, has bred sheep to produce 10 percent less methane. These low-methane sheep are the result of a decade of research. In addition to lower methane emissions, the sheep are leaner and grow more wool.

Potential Risks /Barriers

The main risk in financing research and product development is that the desired results may not be achieved.
Investment costs are high (minimum of $1-$3 million) and returns are longer term

Finance Demand

Demand for financing in this area is likely to increase over the medium to long-term as more emphasis is put on 'sustainable agriculture'.

$5 in the short term to - $20 million over next five years

Type of Project: Sustainable Aquaculture
Size of Opportunity/Demand
The fishing subsector is less than 2% of agricultural GDP and has stagnated over the past few years due to depletion of fishing stock. Demand however for fish continues to rise due to increasing urbanisation and desire for healthier meat substitutes. Over 50% of $300 million market is imported. Opportunity exists for investment in sustainable aquaculture using cage and other technologies.
Potential Risks /Barriers
Access to sustainable source of fingerling stock; Appropriate cost of feeds to compete with imports from China Technical support for smallholder out-growers is limited
Finance Demand
Demand for financing likely to grow over the medium term due to increasing consumer demand for local fish products which are preferred $5 million per year in the short term to $30 million over next five years

3.3 Improved Inputs/Technologies

Some 1.5 billion people globally are dependent on smallholder farm production (defined as farms with less than two hectares of land). They are still operating at a low-income, subsistence level, and are vulnerable to ongoing environmental risk. Helping these farmers to raise yields is important not only for food production and environmental stewardship (given they account for 30 per cent of cropland), but also for tackling rural poverty. In Kenya there are over 3 million smallholder farmers operating with over 50% operating at largely subsistence levels. The scope for improvement is large. For example, in the tea sector yields for the 600,000 smallholder farmers are 60% of those on large plantations; [28] yields in the cereals subsector have also stagnated and farmers are extremely susceptible to fluctuations in weather patterns, droughts, floods etc. Academic evidence shows there is the potential to double current yields – more than on large-scale farms. The range of levers for achieving this yield improvement include extension services, new technology for greater productivity and resistance to drought and pests, improved access to capital (to fund acquisition of necessary equipment), aggregation mechanisms (to achieve economies of scale among smallholders) and better links to markets. A meta-study of smallholder extension services found a median rate of return of 58 per cent, and the available case study evidence demonstrates the large potential impact on total factor productivity (through more capital per worker, better utilization of fertilizers and improved farming practices).[29]

[28] SBA /East African Tea Trade Association research on the Tea Value chain in Kenya, 2017
[29] Valuing the SDG prize for food and agriculture, 2016

3.3.1 Key Investment Areas / Type of Projects Improved Inputs and Technologies

Key investment areas identified in the table below include production and sale of improved seeds, organic pesticides and fertilisers, soil management, mechanization, storage and IT applications.

Table 5: Key Investment Areas Identified

Type of Project: Production and Sale of Improved Seed Varieties
Size of Opportunity/Demand
Over 3 million smallholder farmers growing maize and other cereals – varieties that can resist drought or improve yields can help to reduce vulnerability to climate change.
Potential Risks /Barriers
The main risk in financing new product development is the ability to convince smallholder farmers to adopt; for seed or other early stage companies this means significant cash for working capital Government intervention in seed market particularly can distort prices. Initial investment cost quite high (over $500,000) to do research and get product approvals from KEPHIS and other regulatory bodies
Finance Demand
Demand for financing in this area is likely to increase over the medium and long-term as the demand for improved products increases. Estimate finance demand per year of about $3-$25 million over next five to ten years
Type of Project: Production and Sale of Organic Pesticides
Size of Opportunity/Demand
Over 3 million smallholder farmers growing cereals and horticultural produce that is impacted by pests and disease. Developing specific products that can reduce impact on disease can significantly contribute to increased yields and food security.
Potential Risks /Barriers
The main risk in financing new product development is the ability to convince smallholder farmers to adopt. Initial investment cost quite high (over $500,000) to do research and get product approvals from KEPHIS and other regulatory bodies
Finance Demand
Demand for financing in this area is likely to increase over the medium and long-term as the demand for improved products increases. Estimate finance demand of about $3-$25 million over next five to ten years

Type of Project: Soil Management

Size of Opportunity/Demand

Soil management includes soil conservation, soil amendment and optimization of soil health. Services such as soil testing[30] can be provided to identify the makeup of the specific farm's soil and to provide recommendations for nutrient management and fertilizer application to enhance productivity of the soil.

Potential Risks /Barriers

The main risk is in ensuring farmers see the value of such a service and are willing and able to purchase these services on a continuous basis and as part of their farm management and improvement regimes.

Finance Demand

Demand for financing is likely to grow over the short to medium term due to increasing need for high productivity on smaller parcels of land due to the increased scarcity of agricultural land.

Estimated financing to be relatively low (less than $500,000 per year over the next five years but likely to grow above $1 million after five years as demand increases.

Type of Project: IT Applications

Size of Opportunity/Demand

[31]Drones are increasingly in use in agriculture for the following functions: soil and field analysis, crop spraying and crop monitoring. There are also new developments of drones used for planting.

Potential Risks /Barriers

The main risk is in the regulatory uncertainty currently around the ownership and utilization of drones in Kenya. Investing in providing these facilities and services must be with clear guidance and notification to the relevant government agencies.

Finance Demand

Demand for financing is likely to grow over the medium to long-term as the benefits of the use of drones become wide spread and well documented and as regulation around drone use is established with clear guidelines.

Costs vary from as low as $200 to over $5000 for one drone.

Finance demand likely to grow from very low $10-$20,000 to per year to $500,000 - $1million in five years.

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[30] https://soilright.com/soil-management/
[31] https://www.technologyreview.com/s/601935/six-ways-drones-are-revolutionizing-agriculture/

Type of Project: Warehousing
Size of Opportunity/Demand
Post-harvest losses occur during harvesting, packing, transportation and storage. They are caused by insects, rodents, pilferage, spillage and exposure to the elements i.e. rain, sun etc. Access to proper warehouse facilities can reduce post-harvest losses.
Potential Risks /Barriers
The set up and management of warehousing facilities requires proper technical planning to ensure proper facilities are in place for the specific products the warehouse is to hold. Further, separation of produce must be taken into consideration to avoid any level of contamination. In addition, Insurance and adequate security is critical
Finance Demand
For small storage projects average size of investment is about $2-$3000. For large projects can range from $20 ,000 to as much as $5 -$10 million for cold storage investments. Some players in the value chain are already investing in storage[32]. The estimated immediate opportunity for both small and large projects is $15 million per year expected to grow to $30-$40 million in the medium term (5-10 years).

3.4 Energy Use

The utilization of fossil fuel in agricultural activities and more so in industrial farms e.g. running the ploughs contributes 1.4 per cent to global GHG emissions. In some farms, fuel based chemicals are used to create artificial soil fertility and protect against pests and weeds. Fossil fuels are also used in lighting, transportation and food processing. Exploring alternative sources of energy would result in reduced emissions from these activities. Clean energy is essential in the reduction of emissions. Electricity and heat production account for 25 % of global emissions.

3.4.1 Key Investment Areas / Type of Projects – Energy Use

Presented in the table below are key investment opportunities identified which include biogas production and distribution, rangeland reseeding and sale of biogas manure and other organic fertilisers.

[32] For example, as part of the study we identified one large player in the management of coffee plantations planning for a $10 million storage facility that would use solar power.

Table 6:Key investment Opportunities Identified

Type of Project: Biogas Production and Distribution

Size of Opportunity/Demand

The cost of Ksh 700 (US$7) for a single refill of Biogas is less than the cost of a similar quantity of LPG which retails for approximately Ksh 900 (USD$9) - exactly half the cost of a similar quantity of LPG.[33]The Petroleum Institute of East Africa (PIEA) projects that by 2030 Kenya will have an LPG penetration of 70% of the nine million households. Biodigesters are available to enable farmers turn agriculture waste into energy.

Potential Risks /Barriers

The main risk in financing biogas production and distribution is succeeding in market penetration in a market that is accustomed to LPG. The other risk is in ensuring a steady supply.
Initial investment cost to set up biogas plant is high ranging from $50,000 - $2 million

Finance Demand

Demand for financing in this area is likely to increase over the medium and long-term as the demand for gas increases and further as the supply of manure increases where livestock further increase in number to meet rising food demand.

Type of Project: Rangeland Reseeding Inoculant

Size of Opportunity/Demand

The slurry from biogas is mixed with grass seeds and used as a nitrogen fixing agent. The seeds are sowed in rangelands and grow with little rainfall and almost nil requirement for care.

Potential Risks /Barriers

The main risk is in investing in this technology is failure of the seeds to grow. This can be because of different factors which may be unpredictable due to the newness of the technology. Support from agricultural research agencies is required for its success.

Finance Demand

Demand for financing in this area is likely to increase over the short to medium term as farmers seek alternative sources of fodder given the depletion of most pasture land due to overgrazing as well as limited fodder due to drought because of climate change.

[33] http://www.lpgbusinessreview.com/2017/04/25/lpg-consumption-in-kenya-is-there-a-case-for-subsidy/

Type of Project: Sale of Biogas 'Manure' and Other Organic Fertilisers
Size of Opportunity/Demand
The by-product of biogas production i.e. slurry may be packaged and sold as manure. [34]There are about 800 agro-dealers in Kenya selling fertilizers. They stock up to 500 bags of various types of fertilizers, with large volumes stored mainly during the planting seasons. Fertiliser market more than $350 million annually dominated by maize and tea sector (87%) and horticulture (7%)[35].
Potential Risks /Barriers
The main risks in financing such an enterprise is in the enterprise achieving adequate volumes to attain reliability and profitability. Limited local production and sale of fertiliser (over 90% imported) Limited use of organic products though growing. Limited uptake amongst small-holders (financing constraints) Large import programme by GOK for fertiliser acts as market distortion for private players.
Finance Demand
Although from a very low base, demand for financing in this area is likely to increase over the short and medium term as the demand for organic fertilizers increases. Estimated size to grow from $ 3 million to $25 million in next five years.

3.5 Irrigation

Farms, especially, large farms or plantations rely on huge amounts of water for irrigation. [36]Estimates show that 70% of the world's fresh water sources are used for agriculture and by the year 2050 there will be need for an additional 15 % to feed a planet of 9 billion people. Climate change has caused and is expected to lead to extreme droughts in some of the areas where agriculture is practiced. Smart irrigation is required if these areas are to survive these droughts.

3.5.1 Key Investment Areas / Type of Projects – irrigation

The table below highlights key investment opportunities identified in irrigation. Key area drip irrigation systems which can be for both small and large investors. Also excludes government projects in irrigation which are estimated based on budget data to be in the range of KES 7 billion ($70 million) per year.

[34] http://www.africafertilizer.org/wp-content/uploads/2017/05/FUBC-Kenya-final-report-2015.pdf
[35] Kenya Fertiliser Assessment IFDC 2012
[36] http://blogs.worldbank.org/opendata/climatechange/chart-globally-70-freshwater-used-agriculture

Type of Project: Drip Irrigation Systems

Size of Opportunity/Demand

Drip irrigation can reduce a farm's water consumption by as much as 60 percent and increase crop yield by 90 percent, compared with conventional irrigation methods. Drip kits are expensive costing from USD 180 for a 500 square meter set up to USD 350 for a quarter acre farm. While drip irrigation systems are available, solar powered drip irrigation systems are also a new entrant into this market and have a greater impact in the reduction of GHG emissions as compared to traditional systems.

Potential Risks /Barriers

The main risk in financing drip irrigation systems is the manage-ment of the loan portfolio as the main borrowers would be small scale farmers and risk of non-repayment is high especially where crops fail for oth-er reasons for ex-ample attack from pests and diseases. The main risk in financing drip irrigation systems is the manage-ment of the loan portfolio as the main borrowers would be small scale farmers and risk of non-repayment is high especially where crops fail for oth-er reasons for ex-ample attack from pests and diseases.

Finance Demand

Demand for financing in this area is likely to increase over the short and medium term as more farmers seek to adopt this irrigation in the face or changing climate and persistent droughts. [37]Farmers using drip irrigation are reportedly earning Sh300 a day per quarter acre, compared to Sh130 using rain fed systems.

Finance demand estimated to be $2-$3million per year in the short term growing to more than $5 million after five years.

[37] https://www.standardmedia.co.ke/business/article/2000091944/farmers-warm-up-to-sh20-000-kadogo-drip-kit

3.6 Agriculture and Livestock Insurance

To mitigate against risks associated with crop failure or livestock disease as well as losses caused by natural disasters (droughts and floods) insurance is increasingly becoming an important option. Several companies are investing in the forecasting tools required to assess and price risk although in East Africa it is still in the early stages. Opportunities exist for new market entrants as well as investors to support existing market players expand their product offering.

3.6.1 Key Investment Areas/Type of Projects

Presented in the table below is a summary of opportunities identified in crop and livestock insurance.

Table 7: Summary of Opportunities Identified in Crop and Livestock Insurance

Type of Project: Crop and Livestock Insurance
Size of Opportunity/Demand
There are over 3 million farmers in Kenya and the majority are smallholder farmers. Market penetration of insurance for both commercial and subsistence farmers is still less than 10%. Significant opportunity exists if pricing can be competitive as smallholder farmers annual average return from farming is less than $2000.
Potential Risks /Barriers
Challenge is to price the product effectively to penetrate smallholder market. Capital requirements can be high particularly during bad seasons needing large pay-outs. Investment in appropriate forecasting tools as well as outreach distribution models is high. (minimum $2-$3 million) Payback period long
Finance Demand
Financing for insurance in this emerging market is likely to be a combination of grant, debt and long-term equity. Estimate immediate demand for finance to be $2-$3 million growing to $5-$6 million in five years from both existing and new players in the market.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the data presented a summary of key opportunities is presented below.

4.1 Summary of Investment Opportunities

Table 8: Summary Investment Opportunities

FORESTRY	Impact on Climate Change[38]
	Contributes to up to 10% of total annual emissions
Investment Category: Tree Nurseries	
Market Size $15 -$100 million based on 100 million seedling sales per year.	
Estimated Size of the investment / Financing Opportunity $1.5 million growing to over $5 million in 5 years.	
Key Challenges Relatively longer payback period; Risk perception in early stages by financiers; Market awareness by potential investors.	
Impact on Climate Change Large if scale is achieved.	
Investment Category: Tree Management Services	
Estimated Size of the investment / Financing Opportunity $500,000-$2 million per year in 5 years	
Key Challenges Relatively longer payback period; Risk perception in early stages by financiers; Market awareness by potential investors	
Impact on Climate Change Large if scale is achieved.	

[38] USAID Green House Gas Emissions report on Kenya

LIVESTOCK	Impact on Climate Change[38]
	Contribute over 65% of agriculture emissions

Investment Category: Hydroponic Feeds

Market Size

Animal feed market of over $400 million annually – mainly dairy and poultry.

Estimated Size of the investment / Financing Opportunity

Limited in the short term but growing to over $5million in the next five years.

Key Challenges

Initial capital investment; Penetrating small scale farmer market.

Impact on Climate Change

imited but large if scale is achieved.

Investment Category: Hay farming

Market Size

Animal feed market of over $400 million annually – mainly dairy and poultry.

Estimated Size of the investment / Financing Opportunity

$4 million growing to over $20 million in five years.

Key Challenges

Market awareness of opportunity; Technical know-how; limited finance for small scale farmers.

Impact on Climate Change

Significant if scale is achieved.

Investment Category: Research and Product Development

Market Size

Animal feed market of over $400 million annually – mainly dairy and poultry.

Estimated Size of the investment / Financing Opportunity

Limited ($2-$ 3million) in short term but growing to over $20 million in the medium term.

Key Challenges

Most funding to be done through grant funds or internal company funds; slowly venture and angel funding to emerge.

Impact on Climate Change

Significant if scale is achieved.

Investment Category: Sustainable Aquaculture

Market Size

Fish consumption market of at least $300 million annually 50% being imports.

Estimated Size of the investment / Financing Opportunity

Financing demand growing from $5 million per year to over $30 million in next five to ten years.

Key Challenges

Risk perception by financial institutions; cost of feed; technical support for smallholder outgrowers; consistent supply of fingerlings.

Impact on Climate Change

Significant if scale is achieved.

Agricultural Inputs

Impact on Climate Change[38]

Crop production contributes less than 10% of agricultural emissions

Investment Category: Production and Sale of improved Seed Varieties – drought resistant, high yielding

Market Size

Over 3 million farmers growing cereals and other crops.

Estimated Size of the investment / Financing Opportunity

Estimate finance demand of about $3-$25 million over next five to ten years.

Key Challenges

Ability to sell product to smallholder farmers; access to working capital finance; government subsidies/ intervention in some sectors; high capital costs of developing appropriate varieties.

Impact on Climate Change

Less impact on emissions but higher impact on food security.

Investment Category: Production and Sale of Organic Pesticides

Market Size

Over three million farmers growing cereals and other crops.

Estimated Size of the investment / Financing Opportunity

Estimated finance demand $3 -$25 million over next five to ten years.

Key Challenges

Ability to sell product to smallholder farmers; access to working capital finance; government subsidies/ intervention in some sectors; high capital costs of developing appropriate varieties.

Impact on Climate Change

Less impact on emissions but higher impact on food security.

ENERGY	Impact on Climate Change[38]
	Contributes up to 30% of total annual emissions

Investment Category: Biogas Production and Distribution

Market Size

LPG market worth over $200 million annually – product can substitute.

Estimated Size of the investment / Financing Opportunity

Less than $5 million currently growing to over $10 million in next five years.

Key Challenges

Ability to penetrate LPG market with new product; initial investment costs above $50000; access to consistent supply of raw material.

Impact on Climate Change

With scale can have significant impact.

Investment Category: Rangeland Reseeding Inoculant

Market Size

Feed market of over $400 million.

Estimated Size of the investment / Financing Opportunity

$5 -$10 million over next five years.

Key Challenges

High initial investment cost; penetrating smallholder market.

Impact on Climate Change

Limited initially.

Investment Category: Biogas Manure (organic fertiliser)

Market Size

Fertiliser market over $350 million annually.

Estimated Size of the investment / Financing Opportunity

$3 million growing to over $25 million next five to ten years.

Key Challenges

Increasing uptake with smallholders; market distortion by government in fertiliser market; ability to source reliable product.

Impact on Climate Change

Potential to have large impact if supply increases.

IRRIGATION
Investment Category: Drip irrigation
Market Size Over 3 million smallholder farmers – assume 100 000 farmers purchase in next five years at average cost of $400 creates a $40 million market.
Estimated Size of the investment / Financing Opportunity $3 million per year growing to $5-$6 million per year in the medium term.
Key Challenges Risk perception by financiers; reliable technology providers; access to markets for produce.
Impact on Climate Change Can have significant impact on food security and resource use if scale is achieved.

4.2 Summary Conclusions and Recommendations

Based on the opportunities identified the short- term investment opportunities are approximately $35 million dollars per year growing to over $180 million dollars per year in 5-!0 years across the various subsectors in Agriculture. Immediate financing estimates for climate smart projects are about 3.5% of current bank financing of Agriculture. [39]These are conservative estimates that can grow significantly with targeted support to the sector.

4.2.1 Immediate and Long-Term Financing Needs

Table 9: Summary of Opportunities Identified in Crop and Livestock Insurance

Sub-sector: Forestry
Immediate (next 1-2 years)
$2.5 million
Medium to Long-Term (5-10 years) annual requirement
$7 million
Opportunities identified for SME's
Large opportunities to invest in tree nurseries and to provide tree management services.

[39] Estimated total lending to agriculture in 2017 was about Kshs 100 billion or $1 billion (Central Bank 2018).

Sub-sector: Livestock

Immediate (next 1-2 years)

$11 million

Medium to Long-Term (5-10 years) annual requirement

$75 million

Opportunities identified for SME's

Opportunities for investing hay farming as well as production of climate smart animal feed industry. Significant investment opportunities to enter sustainable aquaculture -production of fingerlings, cage farming.

Sub-sector: Agro-Inputs

Immediate (next 1-2 years)

$6 million

Medium to Long-Term (5-10 years) annual requirement

$50 million

Opportunities identified for SME's

Some opportunities to manufacture and sell organic pesticides as well as produce improved seeds but for larger SME's. opportunities in the marketing and distribution of these products as well. DEMO farms, agrovets etc.

Sub-sector: Energy

Immediate (next 1-2 years)

$13 million

Medium to Long-Term (5-10 years) annual requirement

$45 million

Opportunities identified for SME's

Some opportunities for larger SMEs to invest in production and distribution of biogas fertiliser and other organic fertilisers.

Sub-sector: Irrigation
Immediate (next 1-2 years)
$3 million
Medium to Long-Term (5-10 years) annual requirement
$5 million
Opportunities identified for SME's
Significant opportunities for smallholder investments in drip irrigation.
Total
Immediate (next 1-2 years)
$35.5 million
Medium to Long-Term (5-10 years) annual requirement
$182 million

Key challenges identified to growing the portfolio include:

- Penetrating the smallholder market – in discussion with many market players trying to sell climate smart interventions to smallholders a key challenge was convincing farmers to adopt new practices. The capital required to provide education and extension services is significant and, in many cases, particularly for SME's not available. For processors and other larger players aggregating smallholders into viable commercial entities is also a challenge and very expensive.
- Initial capital required to start investments is a barrier for many new entrants; risk perception of the sector and long payback periods for some investments also limits access to capital.
- For some products government subsidy impacts the investor potential – particularly the inputs markets.
- For some products particularly waste management, access to consistent supply may limit the scale of the investment opportunity.
- Competing cheap imports limits growth of local production of some products like LPG and aquaculture.

Emerging from the challenges **key recommendations** include:

- **Given the risk element of financing projects in this sector, a combination of different forms of funding – grant, equity, early stage and commercial bank funding – will be needed to grow investments in the sector.** This is already occurring in the Kenyan market – there are several impact and grant funds that have been set up specifically targeting climate smart investments in agriculture and other sectors. [40]There is no synergy however between different initiatives to achieve scale. This is recommended going forward.
- In line with the recommendation above, capital requirements for new market entrants is quite high and, in many cases, not available. **There is need for more support for business incubation and early stage funds to allow for more investment in this segment.** For the KGBP a possible entry point could be through existing funds that already have a track record and are looking to expand.[41]
- **Smallholder farmers need to receive much more funding to allow them to adopt new technologies at scale.** At present limited funding is available through banks and microfinance institutions due to the risk perception and inability to ring fence cash flows. Effort needs to be made to provide risk sharing mechanisms to enhance scale. For microfinance institutions some may require additional capital as deposit mobilisation is still low. [42]In addition, support to aggregators and other value chain players like co-operatives can help to increase access to finance. This funding needs to be supported by public investments in extension that will make smallholders more aware of the benefits climate smart technologies.
- To open up agricultural input markets since government is a key player, **government interventions need to be reduced or aligned more closely to private sector requirements** for growth.
- **Channel funds raised through green bond issuance to professional fund management vehicles that** thereafter seek and specifically invest in green investments.
- **Provide incentives for companies that invest in green bonds.** These could include tax incentives or recognition on national platforms.

[40] See for example Kenya Climate Change Venture Fund established with the support of the World Bank. The African Enterprise Challenge Fund has been operating a climate change window for several years and has provided repayable grants to several companies (see examples in the annex).
[41] The National Enterprise Development Fund supported by GOK and SIDA is actively involved in incubation and is looking for scale up – KCVCF and AECF could also be potential partners.
[42] Several pilot projects including one funded by IFAD supporting growth of agricultural finance through MFIs identified access to capital as a constraint for MFIs.

ANNEX I - EXAMPLES OF SPECIFIC PROJECTS IN AGRICULTURE

Mount Kenya Gardens (MKG) Limited

This is a private Kenyan-owned agribusiness in partnership with AGRA, AECF and 10,000 farming households to transform rural economies from subsistence to thriving agricultural enterprises.

Climate Benefit

-Reduction of Green House emissions through non-toxic, traceable foods.

Funding Needs Amount and Use

AGRA/AECF - US$900,000 grant.

Western Seed

The AECF - Western Seed project is making improved seed varieties (maize, sunflower, beans, and the nutritious molafeed for the dairies) available to over 1000 smallholder farmers in Western Kenya using a system of farmer agents and cell-phone based payment systems.

Mitigation /Adaptation

-Drought resistant seed
-Different seed/crop varieties

Climate Benefit

-Reduced environmental foot print.

Funding Needs Amount and Use

Norfund - US$ 1.5 Million.

Freshco

This is a producer of high-yield hybrid seed, primarily maize, to small-scale farmers to double production of its 11 varieties of maize seed and grow revenue.

Mitigation /Adaptation

-Different seed varieties.

Climate Benefit

-Reduced Green House emissions.

Funding Needs Amount and Use

Root Capital/ AECF - $200,000 (2010). $338,000 (2011).

Dryland Seed Limited

The AECF - DSL project is contributing to increased access to high quality seed of improved crop varieties, suitable to Kenyan farmers in arid and semi-arid areas. This business idea will make suitable seeds accessible to the farmers and a Seed Storage Facility (SSF) will act as a seed bank for the region.

Mitigation /Adaptation

-Improved seed/crop varieties
-Improved post-harvest practices

Climate Benefit

Reduced environmental foot print.

Funding Needs Amount and Use

AECF - US$ 508,000.

Kenya Highlands Seed Company Limited

The company supplies Open Pollinated (OPV) and Hybrid seeds to farmers. The AECF - KHS project purpose is to encourage the adoption of hybrid seed, greenhouse and irrigation technologies.

Mitigation /Adaptation

-Greenhouse and irrigation technologies
- Improved seed/crop varieties

Climate Benefit

-Land and water conservation.

Funding Needs Amount and Use

AECF - $600,000.

Dane Bio Pesticide

Eco Sawa is a startup that produces eco-friendly organic pesticide products. The pesticide can be used to prevent a wide variety of insects and pests such as the Desert locust and the Fall Armyworm.

Mitigation /Adaptation

-Organic pesticide.

Climate Benefit

Reduction of Green House emissions.

Funding Needs Amount and Use

Kenya Climate Ventures (KCV)

Kilifi Moringa

This project supports hundreds of smallholder women farmers to grow Moringa and sell the seeds back to them. The seeds are turned into oil for the cosmetics industry. They are building a model - a circular path, with "products" - starting with the seeds bought, from a tree that feeds farmers. They are turned into oil for sale, animal feeds, biogas and organic fertilizer from the by-products, all of which return to farms.

Mitigation /Adaptation

-Agroforestry
-Green energy production

Climate Benefit

- Reduction of Green House emissions.

Funding Needs Amount and Use

AECF - US$ 400,000. **Kenya Climate Ventures (KCV)** - Seed funding US$500,000.

Liquid Lever Irrigation Limited

Liquid Lever Irrigation focuses on small-scale, affordable drip irrigation systems tailored to the needs of the small-scale farmer in Kenya.

Mitigation /Adaptation

-Improved irrigation efficiency.

Climate Benefit

-Water conservation.

Funding Needs Amount and Use

AECF - $360,000.

Agrihouse Solutions

The company offers sustainable smart faming technologies and capitalizes on providing customized climate smart agri-products for the smallholder farmers which include greenhouse packages, shade net houses, water harvesting reservoir, and irrigation systems. It also provides technical support services to smallholder farmers such as agronomic support, training, repairing greenhouses and shade net houses and facilitating market access of their produce.

Mitigation /Adaptation

-use of sustainable technology
-Water efficiency

Funding Needs Amount and Use

Kenya Climate Ventures (KCV)

Mount Kenya Gardens

Grows fruits and vegetables and packages the produce in bulk for local and export markets.The AECF - Mount Kenya Gardens project is supporting market demand with non- toxic and traceable foods.

Mitigation /Adaptation

-Use of innovative agronomic practices to improve production/ unit area.

Climate Benefit

-Reduced environmental foot print.

Funding Needs Amount and Use

AECF - US$ 900,000 Grant.

Teita Estate Limited

It is the single largest sisal plantation in the world. Old sisal plants (boles) which are removed during replanting provide bio-mass which can be converted to energy. The AECF - TEL project will produce 8.1MW of electrical power and the company will work closely with Kenya Power to design, install and manage a local grid system, or to supply power direct to the grid.

Mitigation /Adaptation

-Biogas Production.

Climate Benefit

-Reduction of Green House emissions.

Funding Needs Amount and Use

AECF - $600,000.

Ngare Narok Meat Industries Limited – Rumuruti

Ngare Narok Meat Industries Limited processes meat products including sausages and canned meat. The company also deals in hides and skins, prime beef, organic compound fertilizer and leather products.

Mitigation /Adaptation

-Manufacturing of organic compound fertilisers from abattoir waste.

Climate Benefit

-Reduction of Green House emissions

Funding Needs Amount and Use

Fanisi Capital Ltd - $2.5m (equity and part musharaka). -Fanisi Capital is set to acquire a 40.15% stake.

Hydroponic Africa

They specialize in the manufacturing, installation and marketing of customized hydroponic fodder and vegetable systems to help small and medium holder farmers have access to a high quality, cost-effective and sustainable way of farming.

Mitigation /Adaptation

-Water conservation -No tillage
-Land conservation -Less fertilizer

Climate Benefit

- Reduction of Green House emissions.

Funding Needs Amount and Use

KCV - $350,000 convertible loan **VIA Water -** 117,000 Euros Grant.
Securing Water for Food (SWFF) - US$500,000 Grant..

Simatech Integrated Solutions

They provide solutions in the area of agriculture, green energy and industrial automation. They make automatic chicken feeder cages that have automatic time based feeding system, automatic disinfection of poultry house to prevent dangers of airborne diseases, automatic water supply, automatic lighting system at night, ease of manure collection and disposal and eggs are also counted by the system.

Mitigation /Adaptation

- Improved energy use -solar -Improved feeding practices
-Water conservation

Funding Needs Amount and Use

Kenya Climate Ventures (KCV)

Komaza

Komaza's model is a combination of microfinance and forestry. It partners with smallholder farmers in Kenya to plant trees for sale as sustainable wood products. They provide farmers with the support across the entire value chain.

Mitigation /Adaptation

-Agroforestry.

Climate Benefit

Environmental conservation through tree planting.

ANNEX II - REFERENCES

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ANNEX III - PROJECT PROFILES

[44] Nyongara Slaughterhouse Biogas Production and Rangeland Reseeding

Background

The abattoir cluster in Dagoretti, on the outskirts of Nairobi, Kenya, provides meat to the city and employment to over 5,000 people. Daily, over 400 animals are slaughtered here. Instructed by Kenya's National Environment Management Agency, the City Council of Nairobi was on the brink of closing the cluster in mid-2009, as improper discharge of slaughter wastes was polluting the Nairobi River. The surroundings were stinking, emitting large quantities of methane, and the blood and the wash water were seeping into the ground water. Unreliable grid electricity forced the abattoirs to depend on diesel generator sets. The trees in the once dense woods nearby have been cut down heavily for firewood and charcoal for cooking by the population around the abattoirs. Based on the request of the Ministry of Environment, Government of Kenya, UNEP requested UNIDO to find a solution to the problem. UNIDO implemented an innovative (low cost) solution and its Phase-1 was completed in 2010.

Goals and Objectives:

1. Establish a functional model to reduce GHG emissions from the slaughter wastes through anaerobic conversion of it into energy (Phase 1);
2. Use biogas for electricity generation (Phase 1);
3. Use biogas and recovered heat from generator exhaust to heat water for cleaning in the abattoir (reduce water consumption), replacing firewood or charcoal. (Phase 1);
4. Demonstrate biogas as a viable alternative for cooking for the urban poor in place of scarce firewood and charcoal (phase 1);
5. Demonstrate Biogas bottling after cleaning it of CO2 and distribute as a cooking fuel to the urban poor (Phase 2);
6. Develop business opportunities to market the residue as an organic fertilizer rich in nutrients like nitrates, phosphates and potassium for local farming (Phase 2);
7. Replicate and upscale the model in the whole cluster (Phase 2); and
8. Refurbishing abattoirs within the country to be environmentally clean and be self-sufficient in energy (Phase 3).

[44] https://unfccc.int/climate-action/momentum-for-change/activity-database/momentum-for-change-converting-waste-from-slaughter-house-to-energy-for-productive-use

Impact

The main suppliers and customers of the abattoir are Maasai pastoralists who venture into the Kiserian market to sell their livestock. These Maasai can purchase the gas cylinders and deliver to their homes where charcoal and wood fuel is the main source used for both lighting and cooking.

The slurry, the by-product of the biogas process, was further used to produce a rangeland reseeding inoculant. The nitrogen fixing agent is mixed with grass seeds and spread over depleted rangelands. This technology has been piloted successfully with grass growing even with little rainfall.

The slaughterhouse is educating pastoralists on how to restore rangelands through this reseeding technology. Several demonstration farms have been set up around the Keekonyoike area.

Potential to Scale Up and Replicate

Scientists and Engineers from the Kenya Industrial Research and Development Institute (KIRDI) were involved in the implementation from the very beginning of the activity, which enabled UNIDO to transfer the know-how and skills to local technicians, so that the maintenance, replication and up-scaling process would be very smooth.

Green and Social Bonds Mapping to the Sustainable Development Goals[45]

SDG GOAL 1: No Poverty
Target
1.5
Target Description
By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
GBP Category
Climate Change Adaptation

SDG GOAL 2: Zero Hunger
Target
2.3
Target Description
By 2030, double the agricultural productivity and incomes of small-scale food producers, women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.
GBP Category
Environmentally sustainable management of living natural resources and land use.

[44] https://unfccc.int/climate-action/momentum-for-change/activity-database/momentum-for-change-converting-waste-from-slaughter-house-to-energy-for-productive-use

SDG GOAL 2: Zero Hunger

Target

2.4

Target Description

By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

GBP Category

-Climate Change Adaptation -Environmentally Sustainable Agriculture

Target

2.5

Target Description

By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

GBP Category

Terrestrial and Aquatic Biodiversity Conservation Environmentally Sustainable Agriculture;

SDG GOAL 3: Good Health and Well-health

Target

3.9

Target Description

By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

GBP Category

-Pollution prevention and control -Renewable Energy
-Wastewater Treatment

SDG GOAL 3: Good Health and Well-health

Target

3.d

Target Description

Strengthen the capacity of all countries, developing countries, for early warning, risk reduction and management of national and global health risks.

GBP Category

-Climate Change Adaptation

SDG GOAL 6: Clean Water and Sanitation

Target

6.1

Target Description

By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

GBP Category

Sustainable water and wastewater management.

Target

6.2

Target Description

By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

GBP Category

Sustainable water and wastewater management.

SDG GOAL 6: Clean Water and Sanitation

Target

6.3

Target Description

By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

GBP Category

-Sustainable water and wastewater management. -Pollution Prevention and Control.

Target

6.4

Target Description

By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

GBP Category

Sustainable water and wastewater management.

Target

6.5

Target Description

By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

GBP Category

Sustainable water and wastewater management.

SDG GOAL 6: Clean Water and Sanitation

Target

6.6

Target Description

By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

GBP Category

Terrestrial and Aquatic Biodiversity Conservation.

Target

6.a

Target Description

By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.

GBP Category

Sustainable water and wastewater management.

Target

6.b

Target Description

Support and strengthen the participation of local communities in improving water and sanitation management.

GBP Category

Sustainable water and wastewater management.

SDG GOAL 7: Affordable and Clean Energy

Target

7.1

Target Description

By 2030, ensure universal access to affordable, reliable and modern energy services.

Target

7.2

Target Description

By 2030, increase substantially the share of renewable energy in the global energy mix.

GBP Category

Renewable Energy.

Target

7.3

Target Description

By 2030, double the global rate of improvement in energy efficiency.

GBP Category

Energy Efficiency .

Target

7.a

Target Description

By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

GBP Category

-Renewable Energy. -Energy Efficiency.

SDG GOAL 7: Affordable and Clean Energy

Target

7.b

Target Description

By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.

GBP Category

-Renewable Energy. -Energy Efficiency.

SDG GOAL 8: Decent Work and Economic Growth

Target

8.2

Target Description

Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors.

GBP Category

-Renewable Energy. -Eco-efficient and/or circular economy adapted products, production technologies and processes.

Target

8.4

Target Description

Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead.

GBP Category

-Energy Efficiency. -Eco-efficient and/or circular economy adapted products, production technologies and processes.

SDG GOAL 9: Industry, Innovation and Infrastructure

Target

9.1

Target Description

Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

GBP Category

-Renewable Energy. -Climate Change Adaption.

Target

9.4

Target Description

By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

GBP Category

-Energy Efficiency.
-Renewable Energy.
-Green Buildings.
-Eco-efficient and/or circular economy adapted products, production technologies and processes.

SDG GOAL 11: Sustainable Cities and Communities
Target
11.2
Target Description
By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.
GBP Category
Clean Transport.
Target
11.3
Target Description
By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.
GBP Category
Renewable Energy.
Target
11.4
Target Description
Strengthen efforts to protect and safeguard the world's cultural and natural heritage.
GBP Category
Terrestrial and Aquatic Biodiversity Conservation.

SDG GOAL 11: Sustainable Cities and Communities

Target

11.6

Target Description

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

GBP Category

Pollution prevention and control.

Target

11.c

Target Description

Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.

GBP Category

Green buildings.

SDG GOAL 12: Responsible Consumption and Production

Target

12.2

Target Description

By 2030, achieve the sustainable management and efficient use of natural resources.

GBP Category

Environmentally sustainable management of living natural resources and land use.

SDG GOAL 12: Responsible Consumption and Production	
Target	
12.3	
Target Description	
By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.	
GBP Category	
-Pollution prevention and control.	-Environmentally sustainable management of living natural resources and land use.
Target	
12.4	
Target Description	
By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment	
GBP Category	
-Pollution prevention and control. -Renewable Energy.	-Eco-efficient and/or circular economy adapted products, production technologies and processes
Target	
12.45	
Target Description	
By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.	
GBP Category	
Pollution prevention and control.	

SDG GOAL 13: Climate Action

Target

13.1

Target Description

Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

GBP Category

-Climate Change Adaptation -Renewable Energy

Target

13.2

Target Description

Integrate climate change measures into national policies, strategies and planning.

Target

13T.3

Target Description

Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

GBP Category

Climate Change Adaptation.

SDG GOAL 13: Climate Action

Target

13.a

Target Description

Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

GBP Category

Climate Change Adaptation.

Target

13.b

Target Description

Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities.

GBP Category

Climate Change Adaptation.

SDG GOAL 14: Life Below Water

Target

14.1

Target Description

By 2025, prevent and significantly reduce marine pollution of all kinds, from land-based activities, including marine debris and nutrient pollution.

GBP Category

-Terrestrial and Aquatic Biodiversity Conservation. -Pollution and Prevention Control.

SDG GOAL 14: Life Below Water

Target

14.2

Target Description

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and act for their restoration to achieve healthy and productive oceans

GBP Category

Terrestrial and Aquatic Biodiversity Conservation.

Target

14.3

Target Description

Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

GBP Category

-Terrestrial and Aquatic Biodiversity Conservation -Pollution and Prevention Control
-Climate Change Mitigation

Target

14.4

Target Description

By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

GBP Category

Environmentally sustainable management of living natural resources and land use.

SDG GOAL 14: Life Below Water

Target

14.5

Target Description

By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information'

GBP Category

Terrestrial and Aquatic Biodiversity Conservation.

Target

14.6

Target Description

By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation.

GBP Category

-Terrestrial and Aquatic Biodiversity Conservation

-Environmentally sustainable management of living natural resources and land use

Target

14.7

Target Description

By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism.

GBP Category

-Environmentally sustainable management of living natural resources and land use.

SDG GOAL 14: Life Below Water

Target
14.a
Target Description
Increase scientific knowledge, develop research capacity and transfer marine technology, considering the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, small island developing States and least developed countries.
GBP Category
Terrestrial and Aquatic iodiversity Conservation. -R&D related to GBP categories. -Environmentally sustainable management of living natural resources and land use.
Target
14.b
Target Description
Provide access for small-scale artisanal fishers to marine resources and markets.
GBP Category
Environmentally sustainable management of living natural resources and land use.

SDG GOAL 15: Life On Land

Target

15.1

Target Description

By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

GBP Category

Terrestrial and Aquatic Biodiversity Conservation.

Target

15.2

Target Description

By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.

GBP Category

Terrestrial and Aquatic Biodiversity Conservation.

Target

15.3

Target Description

By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

GBP Category

-Terrestrial and Aquatic Biodiversity Conservation
-Climate Change Adaptation
-Pollution and Prevention Control
-Sustainable Land Use

SDG GOAL 15: Life On Land

Target

15.4

Target Description

By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

GBP Category

Terrestrial and Aquatic Biodiversity Conservation.

Target

15.5

Target Description

Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.

GBP Category

Terrestrial and Aquatic Biodiversity Conservation.

Target

15.6

Target Description

Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed.

Target

15.7

Target Description

Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products.

GBP Category

-Terrestrial and Aquatic Biodiversity Conservation.

-Environmentally sustainable management of living natural resources and land use.

SDG GOAL 15: Life On Land

Target

15.8

Target Description

By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.

GBP Category

-Terrestrial and Aquatic Biodiversity Conservation.

-Environmentally sustainable management of living natural resources and land use.

Target

15.9

Target Description

By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.

Target

15.a

Target Description

Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems.

GBP Category

-Terrestrial and Aquatic Biodiversity Conservation.

-Environmentally sustainable management of living natural resources and land use.

SDG GOAL 15: Life On Land

Target
15.b
Target Description
Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation.
GBP Category
Terrestrial and Aquatic Biodiversity Conservation.
Target
15.c
Target Description
Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities.
GBP Category
-Terrestrial and Aquatic Biodiversity Conservation. -Environmentally sustainable management of living natural resources and land use.

ANNEX IIII - LIST OF PERSONS MET

Green and Social Bonds Mapping to the Sustainable Development Goals[45]

	Name /Position	Organisation
1.	**Anjali Saini** Independent Energy and climate change consultant	**consultant KPMG and formerly AECF**
2.	**Peter Kinyanjui** General Manager, Group Business Development	**ABC Bank**
3.	**Anjali Saini** Independent Energy and climate change consultant	**ABC Bank**
4.	**Lee Gachomba** Head of SME Banking	**ABC Bank**
5.	**Philip Wambua** General Manager Treasury and Financial Institutions	**Barclays Bank of Kenya**
6.	**Dr. L. Murei** Switch Africa Green project manager	**UNDP/Africa Agricultural Trade and Investment FUnd**
7.	**Sheila Karue** Consultant	**UNDP/Africa Agricultural Trade and Investment FUnd**
8.	**Kamala Ernest** Programme Management Officer	**UNDP/Africa Agricultural Trade and Investment Fund**
9.	**Elijah Isabu** SUNREF Program Coordinator	**KAM**
10.	**Joyce Njugu** Head of Consulting	**KAM**
11.	**Grace Kibuthu Ogola** Financial Sector Specialist	**International Finance Corporation**
12.	**Mr. Eric Kimani** Managing Director	**Palmhouse Dairy**
13.	**Wangui Muna** Consultant	**Climate Focus**

14.	**Joshua Anampi**	**National Environmental Trust Fund**
15.	**Almut van Castaren** Director	**Equator Kenya**
16.	**Rishi Kubchandani** Investment Manager	**GROFIN**
17.	**Mr. A. Njagi** Operations Director	**KTDA**
18.	**Masood Mahmoud** Financial Advisor to KCVDF	**World Bank**
19.	**Marion Moon** Proprietor	**Wanda Organic**
20.	**Titus Gitau** Director	**MEA Ltd.**
21.	**Kamau Kuria** Managing Director	**Coffee Management Services Ltd**
22.	**Florence Kariuki** Adviser	**SNV Smart Water for Agriculture**
23.	**Helene Carlson Rex** Program Leader Sustainable Development	**World Bank**
24.	**James Mutonyi** Managing Drector	**AgMark**
25.	**Catherine Watson** Chief of Program Development	**World Agroforestry Center**
26.	**Mr. George Nesbitt** Managing Director	**TEA Warehouses Ltd.**
27.	**Richard Muli** Trade Manager	**AIMS Project**
28.	**Viola Maina** Director	**Smart Farmer Africa**

29.	**Hanna Dohrenbusch** Head Corporate Affairs	**Sunculture,** **Small Scale irrigation**
30.	**Mr. Nicholas Nesbitt** Regional Manager	**IBM Africa**
31.	**Francis Miano** General Manager- Technical Services	**Kenya Tea Development Agency (KTDA)**
32.	**Doreen Mutoro**	**China Road and Bridge Corporation**
33.	**Joan Karani** Operations and HR Manager	**Shengli Construction Company**
34.	**Michael Kariuki** Chairman	**Mt Kenya Matatu Owners Association**
35.	**Anthony Weru** Senior Public Private Dialogue (PPD) Officer	**Kenya Private Sector Alliance (KEPSA)**
36.	**Doris Abaya**	**National Transport and Safety Authority (NTSA)**
37.	**Geoffrey Gangla** CEO	**Genghis Capital**
38.	**Alfonce Iregi** Corporate Finance	**Genghis Capital**
39.	**Ms Aliya Khanbai** Head Industrial Sector	**Stanbic Bank**
40.	**Susan Njuguna** Corporate and Investment Banking	**Stanbic Bank**
41.	**Angela Muga** Corporate Banking	**Cooperative Bank**
42.	**Paul Ohaga** Chief Investment Officer	**Kenya Climate Ventures**

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