Agriculture is key to Kenya’s economy. In 2019, the sector contributed approximately 34 percent of GDP (The World Bank, 2021a) and employed 54 percent of the population (The World Bank, 2021b). The agriculture sector comprises four main value chains: livestock, horticulture, and staple foods (USAID, 2021). While the sector is diverse, with farms varying in terms of both size and efficiency (FAO, 2019a), it is dominated by smallholders, who mainly cultivate maize, beans and potatoes, and keep cattle, small ruminants and poultry (ibid).

In the next 30 years Kenya is expected to face unprecedented growth in the demand for food as both the economy and population grow; GDP per-capita is projected to increase over fivefold, while the population is expected to more than double from 46 million to roughly 96 million (FAO, 2019b). The agricultural sector has been identified as key in contributing to Kenya’s economic growth (FAO and NZAGRC, 2017). As a result, the development of the sector in response to increases in demand, is fundamental in supporting the country’s sustainable development.

Over recent years, agricultural productivity has not increased despite population growth (USAID, 2021). The productivity of the sector is bounded by institutional and economic, as well as agro-ecological factors (FAO, 2019a). Only approximately 20 percent of Kenya’s total agricultural land area is arable, while 80 percent is classified as arid or semi-arid land (ASAL)(ibid.). While the agriculture sector is among the most vulnerable to the impacts of climate change, it is also a leading source of greenhouse gas (GHG) emissions, accounting for up to 40 percent of national emissions in 2015 (Government of Kenya, 2020). The vast proportion of these emissions are from the livestock sub-sector, which contributes 90 percent of total emissions from agriculture (FAO and NZAGRC, 2017). Dairy cattle in particular are responsible for approximately 12.3 million tonnes CO2e, 88 percent of which takes the form of methane produced enterically (ibid.).

Methane is a short-lived climate pollutant with a high global warming potential and atmospheric lifetime of approximately 12 years. Interventions that mitigate methane emissions from livestock in Kenya will have multiple benefits. Curbing emissions will not only reduce Kenya's contribution to near term warming but will also play a key role in Kenya’s transition to a low-carbon, climate-resilient economy, helping to achieve food security and economic growth.
Kenya seeks to undertake an ambitious mitigation contribution towards the Paris Agreement. Kenya’s First Nationally Determined Contribution (NDC) set a target to abate GHG emissions by 30 percent, relative to the BAU scenario of 143 million tonnes CO$_2$e, by 2030. Kenya’s Updated NDC (2020) represents an increase in ambition, with a strengthened GHG emissions abatement target of 32 percent by 2030 (Government of Kenya, 2020b), in addition to the intent to bear 21 percent of mitigation costs, which were previously entirely dependent on international support. For the agriculture sector, mitigation action will take the form of Climate Smart Agriculture (CSA) practices, in line with the Kenya CSA Strategy (KCSAS) (ibid.). The Updated NDC further identifies efficient livestock management systems as a priority under CSA.

Food security is considered a priority for 2018 to 2022 under the Big Four Agenda (2018). The position of the Government of Kenya is that measures to reduce emissions of GHGs will not be adopted if they threaten the country’s ability to feed its growing population or reduce export earnings (Government of Kenya, 2018b). As a result, the role of CSA practices and the KCSAS (Government of Kenya, 2017) are particularly important. The KCSAS aims to sustainably increase agricultural productivity and incomes, adapt and build resilience to climate change within the sector, and reduce the sector’s emissions of GHGs. According to The World Bank (2019), a practice can be considered climate-smart if it maintains or achieves increases in productivity, in addition to at least one other CSA objective (adaptation or mitigation).

The KCSAS identifies three strategic objectives, and actions for the livestock sub-sector, for mitigation related CSA:

1. **Develop mechanisms that minimise greenhouse gas emissions from key sources in agricultural production systems (Strategic Issue 4).** Reducing the rate of emissions from livestock (manure and enteric fermentation) will involve: formulating and implementing low emissions technologies to manage livestock feed and manure; improved animal nutrition by formulating improved feeds and feed additives to reduce emissions from enteric fermentation; developing breeding schemes and improving herd health to enhance efficiency in production; and promoting innovations in livestock management systems that enhance productivity.

2. **Mainstream efficient agricultural production systems to enhance productivity and minimise emissions as a co-benefit (Strategic Issue 5).** This will involve developing and implementing agriculture Nationally Appropriate Mitigation Actions (NAMAs).

3. **Enhanced capacity to measure, report and verify emissions from the agriculture sector (Strategic Issue 6).** Development of Measurement, Reporting and Verification (MRV) Systems to improve the transparency in reporting of actions and mitigation measures in the agriculture sector. This will involve: setting standards and installing MRV infrastructure, as well as developing an inventory system data bank on sector emissions; developing structures to collect data and record GHG emissions, particularly of mitigating interventions; and building the capacity of agricultural sector stakeholders on MRV processes.
The Kenya Climate Smart Agriculture Implementation Framework (KCSAIF) was developed in 2018 to highlight CSA best practice, and to provide options for the implementation of the KCSAS.

Kenya’s updated NDC sits within a broader policy and legislative framework; the update process included a review of existing documents, including Kenya’s National Climate Change Action Plan (NCCAP) 2018—2022 and its technical reports. The Mitigation Technical Analysis Report (MTAR) 2018 – 2022 uses the KCSAS as an input, highlighting its role as a tool that will support the implementation of the NCCAP. The mitigation actions outlined in the MTAR are aligned to support the delivery of food security (Government of Kenya, 2018b). The MTAR identifies the strategic priority of “reducing GHG emissions from agricultural systems without compromising productivity”, and, for the livestock sub-sector, the specific target of implementing a Dairy NAMA, involving 267,000 households in the programme by 2030 (ibid.).

The update process was consultative, including stakeholders from various national and county government sectors, civil society, academia and the private sector (Government of Kenya, 2020b). The development of KCSAS, KCSAIF and MTAR also occurred through extensive stakeholder consultation (Government of Kenya, 2017, 2018b).

Key policies for agriculture emission reductions include:

- National Livestock Policy 2015
- Agriculture Sector Transformation and Growth Strategy (ASTGS) (2019 – 2029)
- Kenya Climate Smart Agriculture Strategy (KCSAS) (2017 – 2028)

Figure 1: Document review framework used in Kenya’s updated NDC. From Government of Kenya (2020)
KEY STAKEHOLDERS

The following are the critical stakeholders involved in the livestock sub-sector emission reduction processes.

- Ministry of Environment and Forest
- Ministry of Agriculture, Livestock, Fisheries and Cooperatives (MOALFC)
- State Department for Livestock (SDL)
- County Governments
- Egerton University - Tegemeo Institute
- Kenya National Bureau of Statistics (KNBS)
- Kenya Agriculture and Livestock Research Organisation (KALRO)
- International Livestock Research Institute (ILRI)
- The National Treasury (TNT)
- Kenya Dairy Board (KDB)

KENYA AND THE CLIMATE & CLEAN AIR COALITION (CCAC)

Kenya became a partner of the Climate & Clean Air Coalition (CCAC) in 2014 and is involved in CCAC’s work on agriculture. The CCAC is supporting work in Kenya in collaboration with the Food and Agriculture Organization of the United Nations (FAO), Global Research Alliance on Agricultural Greenhouse Gases (GRA), and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) to identify emission mitigation opportunities, develop an action plan for livestock GHG accounting and methane mitigation, and to facilitate the implementation of its NDC.

Notably, the CCAC supported:

Assessment of the GHG emissions from the dairy industry, and identification of low-cost mitigation practices: Options for low emission development in the Kenya dairy sector: reducing enteric methane for food security and livelihoods

Practical guidance on how to estimate and collect activity data to compile a Tier 2-based livestock GHG inventory: Livestock Activity Data Guidance, Institutional capacity building for improving Greenhouse Gas Inventories and MRV systems for the Livestock Sector in Kenya, and in support of their Dairy NAMA
The Kenya Climate Smart Agriculture Project (KCSAP), supported by the World Bank, aims to meet the objectives of CSA in targeted smallholder farming and pastoral communities. The KCSAP has generated climate risk profiles for each of Kenya’s counties, and has documented climate-smart technologies for, inter alia, the dairy sub-sector (Onyango et al., 2019).

Kenya has worked with the CCAC, along with the GRA and FAO, to identify methods that reduce methane from enteric fermentation in dairy cattle, while also increasing productivity (Fig. 2) (FAO and NZAGRC, 2017). This work along with the tools it has produced, has increased the capacity of Kenya at the national level to evaluate the potential of mitigation packages in the dairy sector.

The development of agriculture specific NAMAs, will lead to improved livestock management and improved MRV, promoting a multiple-win scenario. The CCAC provided support for Kenya’s Tier 2 GHG emissions inventory from Dairy Cattle (Government of Kenya, 2020a); this informed the development of livestock emissions reduction measures and Nationally Appropriate Mitigation Actions (NAMA) for the dairy industry by the State Department for Livestock (SDL) in 2017. The dairy NAMA will target 267,000 households, approximately 15 percent of Kenya’s dairy cattle (Mbae et al., 2020), with an estimated mitigation potential of 8.8 million tonnes CO2e over a 10-year period (FAO and NZAGRC, 2017). After successful initial implementation it could be further upscaled (Mbae et al., 2020).

The following is a list of all mitigation options analyzed:

<table>
<thead>
<tr>
<th>MITIGATION PACKAGE</th>
<th>REDUCTION IN ENTERIC CH₄ EMISSION INTENSITY RELATIVE TO BASELINE (%)</th>
<th>PERCENTAGE CHARGE IN MILK PRODUCTION (FPCM) RELATIVE TO BASELINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment of fodder grasses and legumes</td>
<td>-15.9</td>
<td>18.4</td>
</tr>
<tr>
<td>Supplementation: Leguminous shrubs</td>
<td>-10.9</td>
<td>12</td>
</tr>
<tr>
<td>Supplementation: Concentrates</td>
<td>-14.4</td>
<td>20.6</td>
</tr>
<tr>
<td>Supplementation: Sweet potato vines and sorghum silage</td>
<td>-48.9</td>
<td>95</td>
</tr>
<tr>
<td>Supplementation: Sweet potato vines, sorghum silage and dairy meal</td>
<td>26.7</td>
<td>35.4</td>
</tr>
<tr>
<td>Urea treated crop residues</td>
<td>-7.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Supplementation: UMMB</td>
<td>-9.9</td>
<td>12.5</td>
</tr>
<tr>
<td>Feed conservation: Sweet potato vine silage</td>
<td>-17.8</td>
<td>20.3</td>
</tr>
<tr>
<td>Vaccination: Control of east coast fever</td>
<td>-20.5</td>
<td>25</td>
</tr>
<tr>
<td>Artificial insemination</td>
<td>-11.6</td>
<td>11.7</td>
</tr>
</tbody>
</table>

**Figure 2:** Options for low emission development in the Kenyan dairy sector. From FAO and NZAGRC (2017).
Low-emissions development of the dairy industry will not only contribute to Kenya’s mitigation target, but will play a role in achieving food security, economic growth, improved livelihoods and environmental protection (ibid.); this will advance progress towards the achievement of the Sustainable Development Goals (SDGs) of Climate Action (SDG 13), as well as No Poverty (SDG 1), Zero Hunger (SDG 2), and Life on Land (SDG 15) (Government of Kenya, 2018b).

**Intrinsic systemic barriers:** The dairy industry is characterised by a number of systemic barriers (FAO and NZAGRC, 2017). These include weak institutional capacity with respect to cooperation and coordination within, and across, sub-sectors at all levels of government (Kimoro, 2021); minimal technical capacity to fully implement policies, legislation and programmes (ibid.); poor infrastructure (FAO and NZAGRC, 2017); and limited incentives for farmers to enter the formal market value chain (ibid.). These barriers highlight that technology alone is insufficient to fully implement a Dairy NAMA. Adequate policies and incentives are required both to minimise the risk faced by stakeholders, and to attract investment to the sector (ibid.).

**Different GHG accounting methods:** Kenya’s latest national GHG inventory (NGHGI; 2010) was developed based on IPCC Tier 1 method, while the Dairy NAMA MRV was based on the IPCC Tier 2 method. As Kenya’s updated NDC is based on emissions scenarios using the NGHGI following the Tier 1 method, the impacts of adopting CSA practices and changes in dairy productivity cannot be captured in the NGHGI and neither reflect the mitigation efforts presented in the NDC.

**Financial support:** In addition to mitigative strategic objectives, the KCSAS also aims to improve policy, regulations and harmonise institutional mandates for CSA (Strategic Issue 8) and to increase funding for CSA activities (Strategic Issue 9). However, the Dairy NAMA has not yet been implemented due to lack of financial support (Mbae et al., 2020).
CASE STUDY 2021 - KENYA

OPPORTUNITIES & NEXT STEPS

Gender inclusion: It is suggested that there is a trade-off between increasing the productivity of dairy cattle, and reducing emissions and benefits for women (Tavenner and Crane, 2018). Women play a critical role in the sector, therefore, addressing gender issues can result in higher mitigation outcomes (Mbae et al., 2020). While the KCSAIF acknowledges the significance of building capacity, it is important that, in the dairy industry, gender inclusion is dealt with at the institutional level (ibid.). The proposed Dairy NAMA has deliberate support to address gender issues through grants to socially excluded groups.

Harmonized GHG accounting methods: Given the conflict between the Tier 1 method used in Kenya’s inventory, and the Tier 2 used in the MRV of a Dairy NAMA, adopting the Tier 2 method in the national GHG inventory is a key step to increase coherence in GHG reporting and mitigation efforts. This will allow project-level initiatives to link with national MRV systems, and track mitigation trends both in terms of absolute emissions and emission intensity reductions. To realise this, support is needed to increase institutional capacity to manage the GHG inventory compilation process, as well as create a data management system that facilitates the preparation of the livestock GHG inventory based on advanced accounting methods (Kimoro, 2021).

Upscaling CSA through climate finance: The KCSAIF outlines a framework that provides broad guidelines for counties, and other stakeholders in the agriculture sector, to develop CSA activities (Government of Kenya, 2018a), highlighting the need to support CSA training programmes relevant to the needs of the county (ibid.). The lack of financial support for the Dairy NAMA stresses the need for more extensive efforts to support the uptake of mitigative actions, as well as a need to upscale private finance, and support access to climate finance (FAO and NZAGRC, 2017).

Increased awareness on role of methane mitigation and policy advocacy: The CCAC is funding work to strengthen institutional capacity, enhance stakeholder participation and awareness, as well as improve understanding of the potential for methane mitigation through NDC and other policy planning processes. Kenya is receiving support to: enhance capacity on the identification of methane mitigation actions that align with the SDGs; to integrate methane quantification and mitigation into existing and planned livestock sub-sector strategies, investments, and policies; and enhance capacity to secure climate finance for transformative action.
SUCCESS FACTORS AND LESSONS LEARNED

Four lessons from Kenya’s experience:

<p>| | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Stakeholders perceive the benefits of a Tier 2-based inventory for tracking changes in emissions and productivity in the sector.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>A clear mandate and leadership from the ministry in charge of livestock was essential to convene stakeholders to support the inventory development process.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Even if there are data gaps, a Tier 2 inventory can be compiled using the best available data. Data quality assessment and uncertainty analysis can help identify key areas for improvement.</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>An initial Tier 2 inventory will always have limitations. If the production systems and animal sub-categories represented are well-chosen, this provides a good framework for continuous improvement in the longer-term.</td>
</tr>
</tbody>
</table>

Emissions reduction in the agriculture sector, and livestock sub-sector is important for achieving the targets of Kenya’s updated NDC. The Dairy NAMA can play a key role in reducing emissions while also increasing the sector’s productivity; however, to track the mitigation efforts and enhance climate ambition livestock emissions estimates in the NGHGI should be based on advanced accounting methods, such as the IPCC Tier 2 method. Consequently, there is a need for additional capacity building support and development of more robust MRV systems.
REFERENCES


Government of Kenya (2018a) Kenya Climate Smart Agriculture Implementation Framework (2018 - 2027). Nairobi, Kenya. Available at: https://drive.google.com/open?id=1XjzMAHQqWu4cY17m15Ma0a7z786o0C.


