# ANNEX 6

Appendix 2 – Country Specific E&S Reports

Version 4

2024

RE-GAIN: Scaling Solutions for Food Loss in Africa

# TABLE OF CONTENTS

# List of Figures

# List of Tables

# 1 Introduction

## 1.1 PROGRAMME BACKGROUND

**A great deal of attention has been paid in recent decades to the impacts of climate change on crop production, i.e., on growing risks to agricultural productivity**. Scholarly investigations and public and private research have invested heavily in identifying and – where feasible – quantifying the ramifications of climate change on crop yields, yield stability over seasons, and in exploring plausible management options for the emerging challenges (CGIAR, 2023). As governments and societies look at how to minimize the risks of climate change, the impact of these changes on food production is increasing, fuelling concerns about food security and livelihoods for current and future generations.

**Food security, however, is affected not only by changes in crop production but by changes occurring throughout the crop value chain, including during post-harvest phases** (Akoth, 2020)**.** It is therefore crucial to examine the impacts of climate change on a crop's value chain, including production, aggregation, storage, transportation, processing, and distribution. Each stage comprises several sub-processes, and climate change may plausibly affect many or all of the sub-processes too.

***With the lion's share of research and resources for resilience interventions in the agricultural sector having been focused on production, the RE-GAIN project is an effort to give dedicated focus to harvest and post-harvest stages of the value chain – specifically, harvesting, post-harvesting handling and storage, processing, transportation, and logistics. As summarized in***
Table 1-1, the International Fund for Agricultural Development (IFAD) report highlights a range of climate change concerns in the post-production stages of value chains and potential adaptation interventions that could increase resilience against such climate change concerns (IFAD, 2015).

***Table 1-1 - Illustrative climate change risks and climate change risk management interventions in post-production value chain processes (adapted from IFAD, 2015)***

| Value Chain Components | Climate Risk Issues | Risk Management Interventions |
|---|---|---|
| **Post-harvest management** | Rising losses in harvest volume; declining safety, market quality and nutritional value due to increasing temperatures, humidity, pests and diseases. | Improve knowledge sharing on harvesting techniques to reduce losses. incentivize waste reduction measures and value addition for by-products; provide renewable energy sources to cover changing requirements for cooling, drying, milling, and threshing. |
| **Siting of processing facilities** | Extreme climate events (such as, floods, heatwaves, and storms) may damage processing facilities; shifting climatic conditions may render some sites redundant or increase transportation costs. It could create sustainable environment to pests and diseases, affecting both product quality and its suitability for consumption | Use hazard exposure and crop suitability maps to inform the siting of processing facilities; retrofit processing facilities with protective features; insure processing facilities against extreme climate events. |
| **Energy in processing** | High dependence on local bioenergy (wood, charcoal, dung, crop residues) has trade-offs with better soil management; rising temperatures require more energy for cooling. | Provide renewable energy sources (such as solar photovoltaic panels for cooling/drying/milling/heating, wind, biogas); equip processing facilities with energy-saving appliances (e.g., solar lighting, solar charging, efficient cook stoves); adopt pollution control measures. |
| **Water in processing** | Declining and more irregular water supplies; growing competition with other domestic or industrial users. | Re-site facilities closer to more suitable water sources; increase water storage and distribution capacity (water harvesting, communal ponds, |

| Value Chain Components | Climate Risk Issues | Risk Management Interventions |
|---|---|---|
| | | groundwater recharge); introduce demand-side water efficiency measures; support conflict resolution for different water users (e.g., water user groups). |
| **Packaging materials and methods** | Rising temperatures and humidity may increase or decrease post-harvest losses and waste, as well as impact food safety, particularly if current packaging materials are impacted by high temperatures leading to produce damage or poor quality. | Design suitable packaging materials in parallel with waste and storage management strategies. |
| **Processing infrastructure** | Buildings and roads are exposed to higher peak rainfall, winds, and heat stress. | Introduce protective features and reinforcements into the design of critical infrastructure to handle run-off and higher temperatures; improve ventilation in buildings; harvest surplus water and energy from rooftops and appliances; use early warning systems. |
| **Transport hubs and routes** | Routes may become seasonally or permanently impassable (or open up); extreme events will disrupt logistics. | Re-site hubs; develop contingency plans for road, rail, water, and air transport; co-design value addition, storage, and transport components to avoid high-risk transport routes and seasons; upgrade docks, jetties, roads, and railways. |
| **Refrigeration and cold chains** | Temperature rises increase requirements for and costs of refrigeration; rising energy requirements increase greenhouse gas emissions. | Conduct cost-benefit analyses of dependency on refrigerated cold chains to assess best routes; introduce renewable energy sources for cooling and ventilation; optimize storage and transport management. |
| **Just-in-time logistics** | Extreme climate events (floods, storms, heatwaves) can make it impossible to comply with "just-in time" requirements. | Develop contingency plans for climate shocks and extreme events; create contingency storage opportunities; link into regional markets to avoid over-dependence on high-value export markets. |
| **Demand from retail and consumers** | Shifts in quantity and quality requirements and seasonality with climatic trends; disruptions in demand with climate variability, hence higher price fluctuations. | Assess market risks and opportunities before value chain implementation, including likely climatic impacts on high-value markets; strengthen and diversify storage to buffer price fluctuations; diversify into "off- season" crops. |
| **Commodity labelling and certification** | Increased consumer awareness as climate change may create new markets for sustainably produced and processed commodities with a low carbon footprint. | Explore opportunities for sustainable procurement, green labelling, and certification. |

AGRA is a continental institution working in 15 African countries addressing food systems focussing on smallholder farmers' production, marketing and nutrition. In the countries where AGRA operates, which are highly diverse in terms of climate, soils, crop choices and institutional capacity, neither all of these climate-related concerns may be applicable, nor all of these potential interventions possible. **Even within the range of what may be applicable, this programme is likely to look at a subset of risks that may be viable to address, and – given resource constraints – only a limited number of high-priority resilience interventions may be feasible to design and deploy.** RE-GAIN is an effort to identify the most salient risks, select the most impactful solutions, and implement the priority interventions through a well-structured, strategic, multi-country programme.

## 1.2 BRIEF PROGRAMME DESCRIPTION

**There is a clear gap in knowledge, data and interventions designed to target the impacts of climate change at the harvest and post-harvest stages of the value chain,** despite the mounting evidence of the ramifications on food loss and the impact this has on land use changes and associated climate change mitigation. The majority of the current programmes designed to tackle climate-induced food loss focus on the pre-harvest stages of the value chain.

**To address the pressing need for broader implementation of solutions aimed at reducing climate-related harvest and post-harvest food loss,** the proposed programme is designed to raise awareness and build capacity to promote the adoption of Food Loss Reduction Solutions (FL-RS). It will do this by creating institutional capacity, facilitating the uptake of FL-RS by end users and service providers, increasing options of solutions' availability, and enabling practical application through policy interventions. This will include enhanced financial access for farmers and Micro, Small, and Medium Enterprises (MSMEs), empowering them to invest in climate-friendly FL-RS and incentivising vendors, manufacturers, and suppliers of climate-adapted FL-RS, fostering a robust market ecosystem.

**A key focus is on strengthening the capabilities of countries to develop climate-resilient post-harvest infrastructure, both through providing physical solutions alongside capacity building along the value chains.** This includes investing in strategic frameworks and implementation plans, including a regulated quality-based pricing system and tax exemptions on imports, for reducing food loss. By enhancing access to markets, the programme will encourage farmers to adopt FL-RS products and services, thereby boosting their climate and economic resilience.

### 1.2.1 Target Countries Overview

During the 2023–2027 period, AGRA plans to target 28 million farmers across 15 Sub-Saharan African countries, 40% of which will be women. The RE-GAIN Programme focuses on AGRA's activities in seven target countries, as shown in Figure 1-1 below. The RE-GAIN Programme is designed to combat food loss during the post-harvest stages and to boost climate resilience by fostering awareness and by building capacity for the adoption of Food Loss Reduction solutions (FL-RS). The programme aims to transfer these solutions to end users and service providers for practical application while facilitating financial access to farmers and Micro, Small, and Medium Enterprises (MSMEs) to invest in climate-resilient FL-RS. The programme plans to incentivize vendors, manufacturers, and suppliers to adopt these solutions and enhance the capacity of countries to develop climate-resilient post-harvest food handling infrastructure.

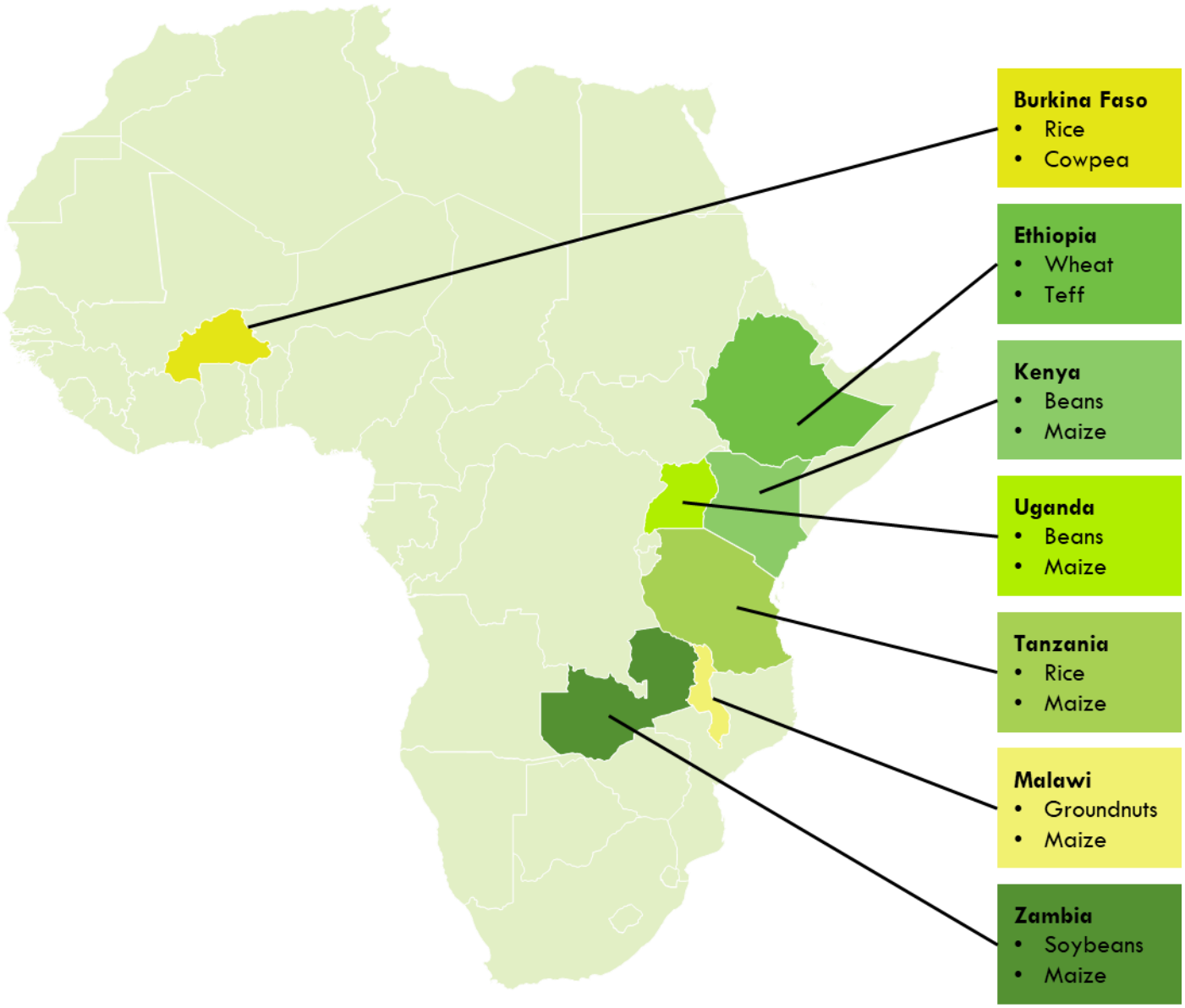



*Figure 1-1 Focus Geographies for AGRA (2023-2027)*

### 1.2.2 Crop selection

**Key crops were identified by major stakeholders in the respective countries and expert assessments, supported by AGRA and the National Designated Authority (NDA) of each target country**. Two major crops per target country were selected, based on area coverage, importance for food security and income, and climate vulnerability, to ensure that sufficient resources would be available for the crafting and execution of targeted solutions. Selected crops are representative of the agricultural dynamics of each country and aligned with the specific needs and strategic agricultural goals of the nation. In addition, these crops hold substantial importance to the country's food security and/or experience particularly high rates of loss within the value chain. Finally, these crops are produced in large parts of the respective countries by a significant number of smallholder farmers. The key crops, therefore, reflect the agronomic and economic realities of each country and provide opportunities for targeted enhancement of food security and sustainable agricultural practices. Additionally, the improved management of these crops is also expected to significantly reduction of GHG emissions contributing to the NDC targets of the countries involved. Figure 1-2 highlights the key crops selected for each of the countries within the programme.

### 1.2.3 Harvesting and Post Harvesting Definition

For the RE-GAIN programme, the key value chain stages considered are shown in Figure 1-2.


*Figure 1-2 Strategic value chain stages included in the RE-GAIN Programme*

**The harvesting process within this RE-GAIN Programme proposal is defined as the interval between the culmination of agricultural production, marked by the crop reaching its maturity, and the initiation of post-harvest treatment**. This process encompasses the identification of the optimal harvesting time and is further delineated into four distinct stages:

1. Removal of contaminated seeds, heads or cobs of matured crops at harvest
2. Reaping, which involves cutting, pulling, or gathering the mature crops.
3. Threshing, the process of separating the grain from the rest of the plant.
4. Cleaning, such as winnowing, to remove chaff and other impurities.
5. Hauling, which entails the transportation of the harvested produce to storage or processing facilities.

**The post-harvest handling and storage stage commences once the crop exits the field and is typically conducted on the farm[1].** This stage encompasses several key operations, including:

1. Threshing, which can be performed manually or with mechanical threshing machines.
2. Drying, utilizing cribs, tarpaulins, and similar methods.
3. Cleaning and sorting, such as through winnowing, to remove impurities.
4. On-farm storage, which includes the use of granaries, hermetic bags, ordinary bags, stacks, metal silos, and plastic silos.
5. In some instances, primary processing activities, such as grinding, hulling, pounding, milling, drying, and sieving, are also conducted during this stage.

**The processing, transportation, and logistics stage involves farmers selling their harvested crops either directly to traders, who collect the produce from the farm, or to collection centres and processors**. These market participants then undertake the tasks of product accumulation, initial processing, quality control, grading, packaging, and transportation to wholesale buyers.

[1] In this instance, a field is where the crops are grown, and a farm consists of the whole small holding including the small aggregation site.

## 1.3 REASONING FOR REQUESTED FUNDING

**Africa's food insecurity challenge has been exacerbated by climate change. Sub-Saharan Africa stands at a crossroads with an unprecedented opportunity for food systems transformation, driven by the demands of a rapidly growing population of 1.5 billion and the pressures of a changing climate** (World Bank, 2023) (Worldometer, n.d.). The continent faces significant development challenges including food insecurity, resource degradation, poverty, gender inequality, and social exclusion. The vicious cycle of poverty and environmental degradation in Africa is evident in low crop productivity, deforestation, land degradation, conflict, migration, and vulnerability to climate shocks, which perpetuate persistent food insecurity and poverty. The effects of climate change are expected to be severe in Africa, where the capacity to adapt and respond to a changing climate is weak.

**The impacts of climate change have increased over the past decades in Africa, manifesting in more frequent, intense, and prolonged extreme weather events, such as floods, droughts, heatwaves, locust outbreaks, desertification, and sandstorms.** These extreme weather events have resulted in increased temperatures and humidity, shifts in precipitation patterns, water stress, and soil erosion. Most African countries already face recurrent droughts that affect growing seasons, often leading to short growing periods reducing the viability of farming in marginal agricultural areas. Projected reductions in crop yields in some countries could reach as much as 50% by 2030, and crop net revenues may fall by up to 90% by 2100, with smallholder farmers being the most affected (IPCC, 2018).

**Therefore, the RE-GAIN programme aims to enhance the climate resilience and adaptive capacity of smallholders by promoting the widespread adoption of FL-RS in seven African countries**. According to the World Bank estimates, a one percent reduction in post-harvest losses in Sub-Saharan Africa could lead to economic gains of $40 million each year, and most of the benefits would go directly to smallholder farmers (World Bank, 2011). Moreover, food loss and waste are the result of an extremely inefficient use of resources and account for about 3.3 gigatonnes of greenhouse gas emissions globally (FAO, 2013). Large amounts of water and fertilizer also go into the production of food that never reaches human mouths. Recovering the food that is lost during harvest and post-harvest handling some can help close that calorie gap in Africa while strengthening livelihoods and improving food security— without imposing any additional environmental cost. Therefore, facilitated by the Green Climate Fund (GCF) investment, RE-GAIN will roll out a suite of physical interventions alongside capacity building and enhanced financial and market access. Not only will this benefit the respective countries as whole, but it also has the potential to benefit the region and the wider planet.

## 1.4 PROGRAMME GOAL STATEMENT

**IF** the capacity of the target countries and communities to respond to climate-triggered food losses is strengthened through improved and inclusive access to financing, promotion of context-specific and gender-responsive innovations to reduce food losses, and better enabling conditions for public and private investments, **THEN** smallholder farmers and other market actors will develop climate resilient agrifood systems that enhance food security and livelihood resilience while contributing positively to Nationally Determined Contribution emissions reductions, **BECAUSE** the widespread use of food loss-reduction technologies will reduce food loss and reduce the carbon footprint of food systems, while increasing household income and building the resilience of smallholder farmers, MSMEs and rural communities to climate shocks.

## 1.5 PURPOSE AND STRUCTURE OF THE REPORT

**The purpose of this report is to provide an assessment of the main environmental and social (E&S) aspects that the seven countries in scope of the programme are currently facing.** The goal of this report is to provide an overview of the key dynamics in each of the countries and highlight the implications of these dynamics for the RE-GAIN programme's implementation. The analysis of the information available in this report is the basis of the Environment and Social Risk Assessment and Mitigation Analysis presented in Appendix 1 of Annex 6.

# 2 Burkina Faso

## INTRODUCTION

**Agriculture is critical to Burkina Faso's economy, employing around 74% of the population and contributing 16.3% to the GDP.** The sector is dominated by small-scale, subsistence farming, particularly in rural areas, with major crops including sorghum, millet, maize, rice, cotton, and groundnuts. Livestock farming also plays a significant role, providing essential products like meat and milk. Despite various government initiatives and international support aimed at modernizing agriculture and improving productivity, the sector faces challenges such as limited access to modern farming techniques, low mechanization levels, and inadequate infrastructure. Efforts to improve the sector focus on enhancing market access, increasing value addition, and promoting sustainable farming practices. Addressing these challenges is essential for boosting farmers' incomes, ensuring food security, and achieving overall economic stability in Burkina Faso (World Bank , 2021)..

**Burkina Faso has implemented various policies and strategies to boost agricultural productivity, sustainability, and food security (see section 1.2).** These initiatives integrate resource management with poverty alleviation, promote agro-ecological practices, increase productivity and market access, and improve water and soil management. They also focus on climate resilience, pest control, and the sustainable development of the agricultural sector to ensure food security and environmental sustainability. Key initiatives include the National Environmental Policy, the National Strategy for Agroecology, and the Agricultural Development and Competitiveness Project, all aimed at modernizing agriculture and enhancing resilience. Despite these efforts, challenges such as limited access to modern farming techniques, low mechanization, and inadequate infrastructure continue to hinder the sector's full potential, requiring ongoing attention and improvement. The lack of implementation of these policies is also related to the broader geopolitical context of Burkina which has experienced two coups in 2022 and several tentative coups in 2023 and 2024.

**Rice and cowpea farming in Burkina Faso face significant risks from the environment due to climate variability (Section 1.3).** The region's reliance on rain and a short rainy season makes crops vulnerable to increased temperatures, heat waves, evaporation, heavy rainfall, and dry periods. Water scarcity is a critical issue, with droughts expected every five years, impacting agricultural productivity. Irregular rainfall exacerbates water availability problems, crucial for rice and cowpea cultivation. Land degradation and soil erosion, driven by poor resource management and climate factors, reduce soil fertility (Lankoandé, 2017). Improper pesticide use poses additional health and environmental risks, contaminating water sources and produce. Addressing these challenges requires sustainable water management, improved land use practices, and proper pesticide training to ensure the viability of rice and cowpea farming in Burkina Faso.

**Smallholder farmers and labourers in Burkina Faso, including those in rice and cowpea farming, face significant social risks**. These include long hours of manual labour under extreme weather conditions, lack of formal contracts and labour protections, and job insecurity leading to exploitation. The seasonal nature of agricultural work causes financial instability due to periods of high labour demand followed by underemployment (IOM, 2021). Health risks are exacerbated by improper pesticide use and inadequate safety measures, resulting in severe health issues. Additionally, women in agriculture face barriers to resources and land access, contributing to gender inequality. Migrant workers, essential to the sector, also encounter legal and labour rights challenges. Addressing these social risks is crucial for improving the livelihoods and safety of agricultural workers in Burkina Faso. Broader security context also affects the agricultural sector, including transport of agri-commodities (Burkina ranks#1 in the Overall Terrorism Index Score - https://www.visionofhumanity.org/maps/global-terrorism-index/#/).

# LIST OF ACRONYMS

| | |
|---|---|
| AMVS | Autorité de Mise en Valeur de la Vallée du Sourou |
| DDPA | Directorate for the Development of Agricultural Production |
| DGAHDI | Direction générale des aménagements hydrauliques et du Développement de l'irrigation |
| DGFOMR | Direction Générale Du Foncier Et De La Formation Du Monde Rural |
| DGIH | Direction Générale des Infrastructures Hydrauliques |
| DGPER | Direction General de la Promotion de l'Economie Rurale |
| DGPV | Direction Générale des productions végétales |
| DPAAH | Directions régionales de l'agriculture et des aménagements hydrauliques |
| DPVC | Direction de la Protection des Végétaux et du Conditionnement |
| DRAAH | Régionale de l'Agriculture et des Aménagements Hydrauliques |
| DVRD | Direction de la vulgarisation et de la recherche-développement |
| FAO | Food and Agriculture Organization |
| GDP | Gross Domestic Product |
| IFAD | International Fund for Agricultural Development |
| ILO | International Labour Organization |
| IOM | International Organization for Migration |
| ITPGRFAA | International Treaty on Plant Genetic Resources for Food and Agriculture |
| IUCN | International Union for Conservation of Nature |
| JICA | Japan International Cooperation Agency |
| MRAH | Ministry for Animal Resources and Fisheries |
| NAP | National Climate Change Adaptation Plan |
| OCE | Office for Climate Education |
| OEC | Observatory of Economic Complexity |
| PMP | Pest Management Plan |
| PNA | Plan national d'adaptation aux changements climatiques |
| PNDES | Plan National de Développement Économique et Social |
| SONAGESS | Société Nationale de Gestion du Stock de Sécurité alimentaire |
| SONATER | Société Nationale de l'Aménagement des Terres et de l'Equipement Rural |
| SWCM | Soil and Water Conservation measures |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USAID | U.S. Agency for International Development |
| WHO | World Health Organization |

## 2.1 PILLARS OF BURKINA FASO'S AGRICULTURAL SECTOR: FOCUS ON RICE AND COWPEAS

### 2.1.1 The Agricultural Economic Landscape

Market overview

The agricultural sector in Burkina Faso plays a crucial role in the country`s economy, it is the primary source of employment in Burkina Faso, engaging around 74% of the total population. It is the main source of livelihood for the majority of Burkinabés, especially in rural areas where subsistence farming is prevalent. This highlights the sector's significance in providing livelihoods for a large portion of the workforce (World Bank , 2022). It contributes significantly to Burkina Faso's Gross Domestic Product (GDP), accounting for approximately 16.3% of the country's GDP (World Bank , 2023). This underscores the economic importance of the agricultural sector in the overall economy. As agricultural land is estimated at 127,786.52 sq. km, equivalent to around 46% of total land (World Bank , 2021). Key aspects of the agricultural sector in Burkina Faso include its primary crops, sorghum, millet, maize, rice, cotton, and groundnuts. These crops are essential not only for food security but also income generation for farmers. In addition to crops, the country also has livestock farming, including cattle, sheep, and poultry, which is important component of the agricultural sector, providing meat, milk, and other products (USAID, 2015).

The government of Burkina Faso has implemented various programs and policies to support agricultural development, improve productivity, enhance food security, and promote sustainable farming practices. These initiatives aim to modernize the sector, increase yields, and reduce poverty among rural communities. Moreover, Burkina Faso receives support from international organizations and donor agencies to strengthen its agricultural sector through funding, technical assistance, and capacity building programs.

Despite the efforts the government and international organizations, the country faces various challenges in its agricultural sector. Access to modern farming techniques is limited; and the level of mechanization in Burkina Faso's agriculture is relatively low, with a significant portion of farming activities still being done manually. This also allows a dependence on rainfed agriculture, and susceptibility to climatic hazards (Ouedraogo, 2006 ). Moreover, inadequate infrastructure that allows market access. As access to markets and value chains is crucial for farmers to sell their produce at fair prices.
The economic and social development of Burkina Faso is closely tied to the performance of the agricultural sector. The sector's growth and resilience are essential for poverty reduction, food security, and overall economic stability in the country. As improving market linkages and value addition in the agricultural sector are essential for enhancing farmers' incomes and overall sector (Direction Générale des Etudes et des Statistiques Sectorielles, 2019).

As a Sahelian country, Burkina Faso faces challenges in producing sufficient food for its population. Consequently, it imports significant quantities of cereals, including rice, wheat, and corn. These imports represent potential investment opportunities. Burkina Faso’s mains agricultural export is Cotton. In 2020, it generated US$233 million in export revenue accounting for 6% of the country’s export earnings. With that, Burkina Faso ranks as the third-largest cotton producer in Africa, with a production of 518,545 tons in the 2021-2022 harvest and nearly $502M in that same campaign. Besides cotton, Burkina Faso also exports sesame and other oily seeds counting for $169M in 2022 as well as cashew nuts ($168M in 2022). These commodities contribute significantly to the country’s agricultural trade (International Trade Association, 2022). Exporting mostly to Switzerland ($6.08B), United Arab Emirates ($538M), Mali ($304M), Singapore ($173M), and Cote d'Ivoire ($171M) (OEC, 2022).

Dominant farming practices

Agriculture in Burkina Faso is characterized by small-scale rainfed subsistence farming with an average farm size of less than 5 hectares. As the lack of personal capital and access to credit leads to extensive agriculture characterized by low levels of agricultural inputs, mechanization, fertilizer use and irrigation. This small-scale agriculture, also known as family farming, concerns 95% of Burkinabe producers and approximately 26% of the total population, emphasizing the importance of small-scale agriculture in the country (Groupe Crédit Agricole, 2022). With a rapidly growing population and little improvement in agricultural productivity, farmers are having to compensate by increasing the area under cultivation. As a result, it is estimated that the country will reach its limit of arable land by 2030 (Knauer, Gessner, & Rasmus Fensholt, 2017). The main agricultural products are cereals (sorghum, maize, millet, rice and fonio), which account for 66% of sown areas, concentrated mainly on small-scale farming. Crop production reached 7,369,365 tonnes in 2020, compared to 6,273,553 tonnes in 2015 (German Cooperation & GIZ , 2022).

Concerning cash crops, cotton is predominant and represent about 60% of total agricultural exports, as roughly 25% of the population derive their income from it in some way. Virtually all cotton is produced on small-scale, family-owned, or communal plots. Other cash crops are groundnut, cowpea, sugarcane, roots and tubers crops (cassava, sweet potato, yam) (FAO, 2024). Burkina also has a potential comparative advantage in several non-traditional cash crops, such as fruits (especially mangoes) and vegetables (such as onions, tomatoes, potatoes and beans) (World Bank , 2024).

Source: Aburawa, 2015

*Figure 2-1 Smallholders farming in Burkina Faso*

Internal-Export dynamics

Burkina Faso's agricultural sector is a crucial component of its economy, with cotton, cashew nuts, and sesame being significant contributors. Below are key details about these major exports:

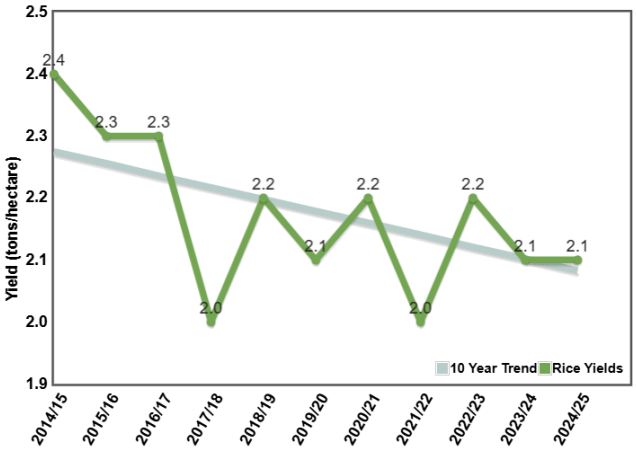
- **Cotton:** As formerly mentioned, cotton is Burkina Faso's main agricultural export. In 2020, cotton generated US$ 233 million in export revenue, accounting for 6% of its total export earnings in 2020. Burkina Faso is the third largest producer of cotton in Africa, producing 518,545 tons in the 2021-2022 harvest. The sector projects 700,000 tons for conventional seed cotton and 2,500 tons for organic cotton for the 2022-2023 harvest (International Trade Association, 2022).
- **Cashew Nuts:** In 2021, the country also shipped out over 92,000 tons of cashew nuts, a significant increase from the 62,000 tons exported. The country was ranked 6th in Africa in cashew nut exports in the same year (Freshela, 2024).

- **Sesame:** In 2020, Burkina Faso' sesame supply represented 1.9% of world exports and was ranked that year as the 13th sesame exporter worldwide with 60,770 tons exported, equivalent to 64,4 million US$ (Ministere De L'Industrie, Du Commerce Et De L'Artisanat, 2021).

### 2.1.2 Rice Crop overview

Market analysis: In Burkina Faso, rice constitutes the fourth most important staple crop after millet, sorghum and maize, and the demand for rice has increased more quickly than for other food sources, especially in cities (Barbier, 2008). Numbers fluctuate but indicate a huge gap in domestic rice production compared to consumption. In 2017 Burkina Faso produced 325,566 tons of paddy rice, corresponding to around 195,340 tons of milled rice, while also importing 431,917 tons of milled rice, for a combined value of US$15.6 M (OCE, 2017). Rice production in Burkina Faso is promising because of good yields and many longstanding rice farmers. While rice consumption in Burkina Faso is constantly increasing, national rice production covers no more than 47% of population needs. Paradoxically, in 2022, Burkina Faso exported US$ 254k in Rice, making it the 108th largest exporter of Rice in the world. At the same year, Rice was the 124th most exported product in Burkina Faso.

The main destination of Rice exports from Burkina Faso are Benin (US$ 148k), Liberia (US$ 73.3k), Togo (US$ 25.4k), and Germany (US$ 6.73k) (OEC, 2024).
Burkina Faso has strong unexploited potential for rice growing less than 10% of the 500,000 ha of lowland has been developed (Grow Africa).

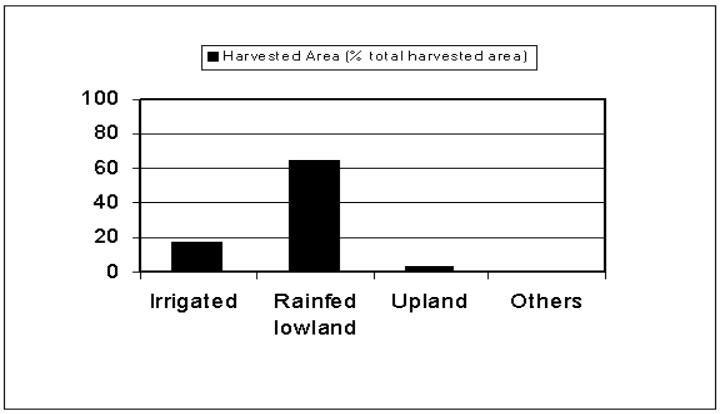



Source: Foreign Agriculture Service, 2024

*Figure 2-2 Burkina Faso rice yields production*

Dominant farming practices and value chain: Burkina Faso has a Tropical Steppe & Semiarid to a Tropical Wet & Dry climate that is ideal for rice production. That's how rice became the fourth major cereal produced in Burkina Faso. Both African rice (Oryza glaberrima) and Asian rice (Oryza sativa) are cultivated in Burkina Faso. However, Asian rice is more dominant. It is cultivated in three agro-ecologies (JICA, 2016):

- **Modern Irrigation Schemes:** Covering 14% of the total production area.
- **Lowland with Traditional Water Management:** Representing 32% of the total production area.
- **Rain-fed Upland and Lowland:** Encompassing 23% and 24% of the total production area, respectively.




Source: FAO, 2000

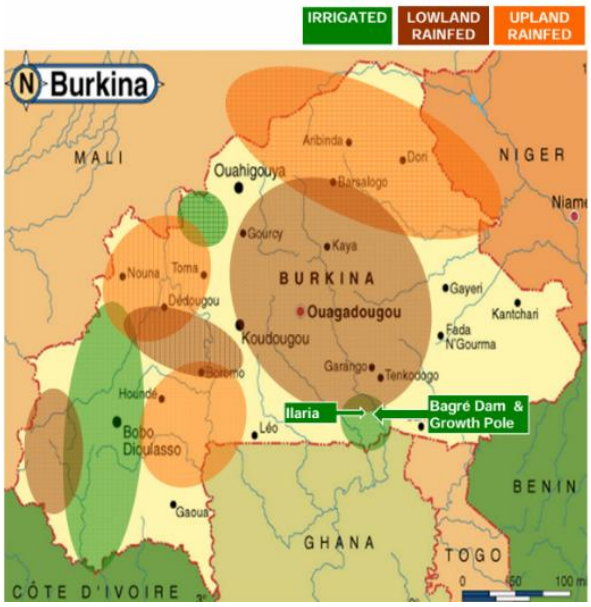
*Figure 2-3 Harvested areas from different ecologies*

Rice farming in Burkina Faso is categorised as 'upland' and 'lowland' depending on the area of plantation. Upland rice is grown as a monocrop or as in a mixture with other food crops following the slash-and-burn shifting cultivation almost with no chemical fertilizer and other agro-chemical. On the other hand, the size lowland rice farms per farmer is generally smaller (from few hundred to few thousand square meters). In these farms, women are dominant rainfed farmers, while men are dominant irrigated rice farmers. In rainfed lowland areas rice-other food crops are practised if water supply is assured, while in irrigated rice areas, double rice cropping is dominant. To this day, rice production in Burkina Faso faces many challenges, such as fragmented value chains, limited access to capital, and competition from cheaper imported rice. Nonetheless, opportunities lie mainly through improving productivity, enhancing farming skills, investing in irrigation, and promoting locally produced rice (Grow Africa). Farmers generally apply little fertilizer to rainfed lowland. However, moderates to high rates of inorganic fertilizers are usually applied to irrigated rice. Information on rice response to fertilizer application, however, is limited. Weeding is generally done manually, although the use of herbicides is increasing in irrigated rice. Farmers do not have adequate appropriate tools and equipment for harvesting and threshing of rice (FAO, 2000).

Source: Furaha, 2011

*Figure 2-4 Rice Farming in Burkina Faso*

Regional focus areas: Irrigated rice is mainly present in the West region of the country with an emerging production region in Bagréis due to good transport links to Ouagadougou, with an average yield of 3.4 MT/ha. Lowland Rainfed rice production is concentrated in Ouagadougou region as well as the west with an average yield of 2 MT/ha. the Upland rainfed rice is mainly in the North Est with an average of 1MT/ha as average yield in those regions.




Source: Stephanie Diakité, 2012

***Figure 2-5 Rice production map in Burkina Faso***

Hauts-Bassins is the top region by rice production in Burkina Faso. As of 2018, rice production in Hauts-Bassins was 64,471 tonnes that accounts for 19.80% of Burkina Faso's rice production. The top 5 regions (others are Boucle du Mouhoun, Centre-Est, Est, and Cascades) account for 73.67% of it. Burkina Faso's total rice production was estimated at 325,566 tonnes in 2018 (knoema, 2019).

### 2.1.3 Cowpeas Crop overview

Cowpea production is one of the traditional rural activities in both Burkina Faso and Niger. Cowpea grows with little water, making it ideal for the Sahel. As cowpea also fixes nitrogen in the soil, it is a common choice for rotation with millet and sorghum. Cowpea (Vigna unguiculata [L.] Walp.) is one of the cheapest sources of protein for rural people in Burkina Faso. Harvested before the cereal crops, cowpea is considered as a ‘‘hungry season crop” or poor’s meat. Its potential to address food and nutritional security in Burkina Faso and beyond is well established. Cowpea also constitutes in Burkina Faso an important source of income to satisfy the needs of families in rural areas. It is grown in all agro-ecological area of the country (Antoine Barro, De La Salle Tignégré, & Bougouma, 2018).

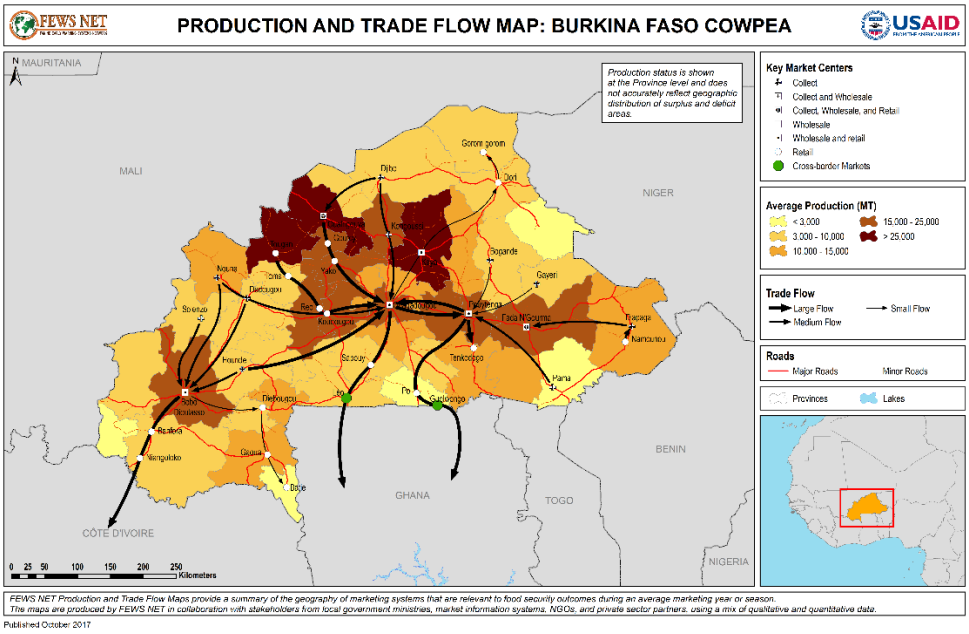
Market analysis: In 2018, the country produced 630,000 tonnes of cowpeas. However, widespread soil erosion, desertification and drought mean yields for this crop remain below potential. Burkina Faso is among the net exporters of this crop according to a study done by along with Niger, Benin, Mali, Cameroon, Chad and Senegal. (A.S. Langyintuo a b, 2003). However, no estimations of the exports specific to Burkina Faso were found.

Dominant farming practices and value chain: Cowpea production is one of the traditional rural activities in Burkina Faso. Cowpea grows with little water, making it ideal for the Sahel. As cowpea also fixes nitrogen in the soil, it is a common choice for rotation with millet and sorghum, although mono-cropping of higher-value cowpea varieties is becoming more common. Yields differ widely whether cowpea is planted by itself in a single-cropped field, or intercropped, whereby 4 rows of millet are alternated with 4 rows of cowpea. The two plants are complementary in that cowpea fixes nitrogen in the soil and the millet roots contribute to greater soil conservation of water. The 2003 Burkina Faso Action Plan for Cowpea noted cowpea yields

under intercropping systems at 300 kg/ha. However, a2009 Purdue study showed Burkina Faso's yields at 777 kg/ha (USAID, 2016).

In Burkina Faso, cowpeas were cultivated in small-scale farms. It was common for women to have their own plots of land next to their family plots. Family plots are managed by the head of the family, who is responsible for the entire family's food consumption and income, while women's plots are managed by women who can decide what to grow. However, as cowpea production has increased in quality and quantity, cowpea has transitioned from being an exclusively "women's crop" grown on small plots of land to a market-driven cash crop grown on a large scale predominantly by men. A combination of family and hired labour makes up the workforce, the latter especially important during the peak labour seasons of planting and harvest (Sakiko Shiratori, 2020).

Regional focus areas: There are climatic differences within Burkina Faso, particularly by longitude, and there are three climatic zones from north to south: Sahelian, Sudan-Sahelian, and Sudanian. Since cowpea requires less rainfall than most crops, cowpea production is concentrated in zones where rainfall is relatively limited, mainly in the northern and central parts of the country (figure below) (Sakiko Shiratori, 2020).




Source: FEWS NET, 2017

***Figure 2-6 Production and trade flow of cowpeas in Burkina Faso***

### 2.1.4 Post-Harvest Food Loss Analysis – Rice and Cowpeas

In Burkina Faso, rice experiences food loss during various stages of the post-harvest process. During drying and harvesting, the loss is 4.40%, while shelling and threshing account for a 3.10% loss.
Winnowing leads to a 2.50% loss, storage at the household level results in a minimal 0.20% loss, and transportation from the field contributes to a 1.30% loss. These figures were reported by the APHILIS database.

For cowpea, food loss is significantly higher at the harvesting stage, with a 12% loss primarily due to inefficient harvesting practices and limited labor availability, especially when crop maturation overlaps with cereal crops. Threshing and winnowing cause a 1.10% loss, often due to spillage and breakage, compounded by limited access to mechanized threshing. Transportation losses are relatively low at 0.30%. Storage presents a significant challenge, with losses ranging from 3.3% to 8%, mainly due to insect damage and damp storage conditions, while mold can cause additional losses between 0.3% and 1.8%. These figures are drawn from a study by FAO, PAM, and FIDA (2019).

## 2.2 E&S POLICY FRAMEWORK

### 2.2.1 Agricultural National Strategies

Burkina Faso has implemented various policies and strategies to enhance agricultural productivity, sustainability, and food security. These initiatives focus on integrating resource management with poverty alleviation, promoting agro-ecological practices, increasing productivity and market access, and improving water and soil management. Additionally, they address climate resilience, pest control, and the sustainable development of the agricultural sector, ensuring food security and environmental sustainability. Burkina Faso has implemented various policies and strategies to enhance agricultural productivity, sustainability, and food security. These initiatives focus on integrating resource management with poverty alleviation, promoting agro-ecological practices, increasing productivity and market access, and improving water and soil management. Additionally, they address climate resilience, pest control, and the sustainable development of the agricultural sector, ensuring food security and environmental sustainability.

National Environmental Policy (2005): The overall objective of the policy is preserving resources and their management integrated into the fight against poverty and the national economy. The Policy aims to improve the availability and accessibility of food products; and improved food security for the entire population. The Policy provides for actions to make agriculture, forests and fisheries more productive and sustainable. The Policy also aims to work towards more inclusive and efficient agricultural and food systems through diversification of production and intensification of income-generating activities, and thus market-oriented agriculture.

National strategy for the development of agroecology 2023-2027: The strategy was designed to assist the Burkina Faso's investment in agroecological intensification to achieve sustainable food and nutrition security in an environmental context characterized by reduced rainfall, degradation of soil and water resources. loss of biodiversity and recurrence of drought and flood sequences. The overall objective is to sustainably increase agro-sylvo-pastoral, fisheries and wildlife productivity and production through agro-ecological intensification. Main challenges addressed by strategy include: (i) large-scale application of agroecological practices throughout the national territory according to agro-climatic zones and (ii) strengthening the governance of agroecology in Burkina Faso.

Action plan of the National Strategy for the Development of Agroecology 2023-2025 in Burkina Faso: This plan covers the period 2023-2025. National Strategy for the Development of Agroecology which covers the period 2023-2027 Law N 34-2018/AN on the steering and management of development specifies that strategies are rationalized through action plans. The national strategy is built around the following three pillars: (i) improvement of the governance of agro ecology; (ii) scaling up agroecology in all regions of Burkina Faso and (iii) capacity building of agroecology actors and support agents. The action plan includes relevant activities to achieve the expected effects as well as the specific objectives of the strategy.

National strategic plan for agro-sylvo-pastoral investment (PNIASP) (2021-2025): The plan aims to sustainably increase the productivity and access of agro-sylvo-pastoral, fisheries and wildlife products to markets with the effect of improving food and nutrition security and accelerating the structural transformation of the economy. The plan expects effects in the four thematic areas including the improvement of agricultural productivity, animal and fishery productivity, forestry and wildlife production, and agricultural production with water control. The Plan also aims to strengthen the land security of agro-sylvo-pastoral, fisheries, and wildlife production areas and the resilience of households and production systems.

Agro-sylvo-pastoral production sector policy 2018-2027: The policy is consistent with the National Economic and Social Development Plan (PNDES). The general objective of this policy is to develop a productive agro-sylvo-pastoral production sector that ensures food security, is more market-oriented and creates decent jobs on sustainable production and consumption patterns. To achieve this objective, three strategic axes have been defined: food and nutrition security, resilience of vulnerable populations (Axis 1); Competitiveness of agro-sylvo-pastoral, fisheries and wildlife sectors and access to markets (Axis 2); and the sustainable management of natural resources (Axis 3).

2020 activity programme of the Ministry of Agriculture and Hydro-Agricultural Management: It is a sectoral document of Burkina Faso National Port. The main objective is to produce cereals for this agricultural season at 5,670,615 tonnes, of which 5,233,939 tonnes are outside the agricultural season and 436,676 tonnes are rainfed and the dry season. For dry season production, about 7,518 tonnes of maize and 124,003 tonnes of rice are expected. The programme aims to contribute to the food and nutrition security of vulnerable households; coordination of the system for the prevention and management of food and nutrition crises; strengthening and management of food security stocks; strengthening the resilience capacities of vulnerable households; and prevention of malnutrition.

National Strategy for Soil Restoration, Conservation and Recovery in Burkina Faso 2020-2024: National Strategy for Soil Restoration, Conservation and Recovery in Burkina Faso 2020-2024 is a national sectoral document. The main objective is to reduce/reverse the trend of soil degradation with a view to sustainably increasing agricultural production. The strategy is complemented by Action Plan for the National Strategy for Soil Restoration, Conservation and Recovery in Burkina Faso 2020-2022. Actions to make agriculture, forests and fisheries more productive and sustainable are provisions of the strategy.

Agricultural Development and Competitiveness Project (PDCA): PDCA also aims to work towards more inclusive and efficient agriculture and food systems. The PDCA provides for actions to make agriculture, forests and fisheries more productive and sustainable. The PDCA's forecasts aim in particular to contribute to the structural transformation of the agricultural sector to boost economic growth, improve the competitiveness of promising value chains and ensure food and nutrition security in a sustainable way.

Pest Management Plan (PMP) 2019: PMP's main objective is to prevent or mitigate the impacts of pesticide use on the human environment and to propose a framework for pest control and pest management, pesticides and their residues. The plan proposes an action plan for the management of pests and pesticides and other plant protection products, raises awareness/educate transporters, producers and users on good storage practices.

Action Plan 2021-2025 of the National Programme for Water Management by 2030: The Plan was validated in 2017 and adopted by Decree N 2018-088/ MEA/CAB of 18 June 2018 and placed under the responsibility of the General Directorate of Hydraulic Infrastructures (DGIH). It is a strategic vision of the fight against poverty through sustained economic growth through the promotion of hydraulic management by 2030 for the benefit of different uses. Through projects and programs, the mobilization and control of water resources in order to improve agro-sylvo-pastoral and industrial productivity and especially the satisfaction of water needs for all uses. The programme is implemented in three five-year phases carried out with action plans. This action plan takes into account the risks that may have a negative or positive impact on its implementation, such as political and social instability, insecurity, the financial crisis, the health crisis and the effects of climate change, and resulting from the updating of the water policy and strategy document.

National Climate Change Adaptation Plan (NAP) (June 2015): The plan was developed to address the difficulties in 2007 National Climate Change Adaptation Plan (NAP), which were mainly related to the insufficient consideration of climate change in development policies and strategies; and the lack of funding during their implementation. The vision of the plan is to manage the country's economic and social development more effectively through the implementation of planning mechanisms and measures that take into account resilience and adaptation to climate change by 2050. Following the guidelines of the UNFCCC, the overall objectives of NAPs are as follows: to reduce vulnerability to the impacts of climate change by developing adaptive and resilient capacities; Facilitate the integration of climate change adaptation, in a coherent manner, into new or existing policies, programmes or activities, into specific development planning processes and strategies within relevant sectors and at different levels. The plan specifically focus on Adaptation action plan for the agricultural sector, drafting 4 specific objectives to be addressed: i) recover and restore the fertility of degraded soils; ii) Improve access for farmers to high-quality agricultural production factors (equipment, inputs, land, agricultural research outcomes etc.); iii) increase stakeholder resilience to climate change; iv) develop early warning systems to ensure efficient management of variability and climate change.

National Water Policy 2015: The policy aims to effectively manage Burkina Faso's water resources to achieve the universal right to water and sanitation and contribute to sustainable development by the year 2030. The overall objective of the policy is to contribute to the sustainable development of the country, by providing appropriate solutions to water problems, in an environment particularly affected by climate change and in compliance with integrated management of water resources. The policy is guided by the following principles: the principle of management of water resources by river basin or aquifer, the principle of need, the principle of subsidiarity, the principle of harmonious development of the different regions of the country, the principle of protection of people and nature, the principle of withdrawal-pays principle, the polluter-pays principle, the information and participation principle, the equality principle, the precautionary principle, the gender principle, the prevention principle, the accountability principle, the non-regression principle, and the partnership principle.

National Rice Development Strategy (2011): This is a sectoral document with the overall objective of contributing to a sustainable increase in the quantity and quality of national rice production in order to meet the needs and requirements of consumers. The strategic axes identified in the context of achieving the objectives of this strategy are: Axis 1: Increase in the areas exploited; Axis 2: Sustainable intensification of rice production; Axis 3: Enhancement of rice production; and Axis 4: Research Dissemination, support and advice, capacity building of actors.

### 2.2.2 Key Legislation

Constitution of Burkina Faso (1991): The Constitution of Burkina Faso was approved by referendum on June 2, 1991, formally adopted on June 11, 1991, and amended on 27 January 1997 and on 11 April 2000. Article 14 of the constitution prescribes that natural wealth and resources belong to the people. They are to be used for the improvement of their living conditions and within the framework of sustainable development. Under article 15, the right to property is guaranteed, but it should not be exercised to the detriment of society or in a manner that harms the security, liberty, existence, or property of others. Burkina Faso has consistently allocated at least 10% of its national budget to agriculture since 2003. These expenditures often support cotton production, one of the country's main exports, through input subsidies and minimum prices to producers (Food and Agriculture Organization , April 2014).

Law No. 034-2012/AN of 2 July 2012 on agrarian and land reorganization in Burkina Faso: This Act determines, on the one hand, the status of land in the national land domain, the general principles governing the planning and sustainable

development of the territory, the management of land resources and other natural resources and the regulation of real property rights, and, on the other hand, the guidelines for an agrarian policy.

Law No. 025-2017/AN of 15 May 2017 on plant protection in Burkina Faso: The law regulates the sanitary protection of plants, plant products and other regulated articles, including products of modern biotechnology, without prejudice to any other legislation relating to the protection of forests, water, the protection of seeds, soils, and the control of the quality of foodstuffs of plant origin. The provisions of this Law applies to all activities and all aspects of the health safety of plants, plant products and products of plant origin with a view to: protecting the national territory from the introduction and spread of harmful organisms, which may affect the health of cultivated or spontaneous plants, or the quantity and quality of harvested products, combating harmful organisms responsible for quantitative losses, or of agricultural, forestry or fodder production, while maintaining at an acceptable level the effects on human or animal health and on the environment, in particular when using plant protection products; promote the quality of crop production for domestic consumption and export.

Law No. 070-2015/CNT on the Agro-Sylvo-Pastoral, Fisheries and Wildlife Orientation Law in Burkina Faso: This law sets the main guidelines for the sustainable development of agro-sylvo-pastoral, fisheries and wildlife activities with a view to achieving food sovereignty and food and nutritional security. This Act applies to all agrosilvo-pastoral, fishery and wildlife production activities, as well as to related activities that are an extension of production, including the marketing, transport, conservation, packaging, storage and processing of agro-sylvo-pastoral, fishery and wildlife products.

The specific goals of the law include the increase in the performance of the rural sector and its contribution to economic growth; the reduction of poverty in rural areas through the creation of jobs and the reduction of the rural exodus, the improvement of producers' incomes and the improvement of the environment and living conditions in rural areas, and the promotion of productive investment in the rural sector.

Law No. 017-2018/AN of 17 May 2018 on the Code of Agro-Sylvo-Pastoral, Fisheries and Wildlife Investments in Burkina Faso: The purpose of the code is to promote productive investments in the agro-sylvo-pastoral, fisheries and wildlife fields contributing to the economic and social development of Burkina Faso. This law applies to primary production, hydraulic management and water control activities; local production of equipment or inputs; artisanal or semi-industrial processing activities of agro-sylvo-pastoral, fishery and wildlife products; provision of services and support for the production, processing and conservation of agro-sylvo-pastoral, fisheries and wildlife products.

Law No. 020-2019/AN on access to physical resources for food and agriculture and the sharing of benefits resulting from their use: Provisions by this law include regulation of access to plant resources for food and agriculture and the sharing of benefits arising from their use, in ABS, in application of the International Treaty on Plant Resources for Food and Agriculture in the form of ITPGRFAA of 3 November 2001. Specific objectives are as follows: to determine the procedure for access to plant resources for food and agriculture through bio-prospecting, collection and exchange for the purposes of scientific research, education, training, conservation or agricultural application; to ensure the sharing of benefits arising from the use of plant resources for food and agriculture; and to promote the sustainable management and use of these resources, thereby contributing to the conservation of national biological diversity for present and future generations.

Law No. 006-2013/AN on the Environmental Code of Burkina Faso: Law No. 006-2013/AN on the Environmental Code of Burkina Faso sets the basic rules that govern the environment in Burkina Faso. The Code aims to protect every living people against harmful or inconvenient damage and risks that hinder or endanger their existence due to the deterioration of their

environment and to improve their living conditions and affirms that the promotion of a healthy environment is a general interest and an obligation for all natural and legal persons. Title II of the law focuses on climate change, the maintenance of ecological balances and improving the living environment. Article 17 stipulates that the government must take action on the adverse effects of climate change. Article 24 states that the government must take the necessary measures to adapt the occupation of the national territory to the requirements of climate change, the maintenance of ecological balances and the improvement of the living environment. The Code is composed of 148 articles divided into five (5) titles, namely: general provisions (I); climate change, the maintenance of ecological balances and the improvement of the living environment (II); administrative sanctions and the punishment of infringements (III); of the miscellaneous provisions of title (IV), and of the final provisions (V).

Law No. 026-2017/an of 15 May 2017 on the control of pesticide management: This law establishes a control of the management of pesticides in Burkina Faso which aims to ensure: the regularity of the procedures for production, shipment, import, export, reconditioning, transit, transport, distribution, storage, use, destruction of the pesticide and advertising; the quality of pesticides; compliance with the standards of labelling, packaging and approval procedures. The law has established procedures for production, testing, import, export, repackaging, transit, transport, distribution, storage, use, destruction of the pesticide and advertising are regular; the quality of pesticides; compliance with the labelling, packaging and approval procedures standards.

Decree No. 2019-0588/PRES/PM/MSECU/MCIA/MAAH/MEEVCC/MEPTSP/MATDC/MINEFID of 05/06/2019 on the control of pesticides in Burkina Faso: This decree sets out the modalities for the control of pesticides in Burkina Faso, in accordance with the provisions of Article 11 of Law No. 026-2017/AN of 15 May 2017 on the control of pesticide management in Burkina Faso. Control is carried out at the different stages of the life cycle of pesticides from formulation, testing, reformulation, repackaging, import, export, transit, transport, storage, distribution, advertising, use and destruction.

Decree No. 2019-0493//PRES/PM/MAAH/MEEVCC/MS/MCIA/MINEFID/MEPTPS of 22/05/2019 on the control of procedures for the destruction of obsolete pesticides: The decree provides the procedures for the destruction of obsolete pesticides, in accordance with the provisions of Article 47 of Law No. 026-2017/AN of 15 May 2017 on the control of pesticide management. Methods and standards for the destruction of obsolete pesticides are specified by decree.

Decree No. 2019-0509/PRES/PM//MCIA/MAAH/MEEVCC of 22/05/2019 on general conditions for the issuance of pesticide approvals in Burkina Faso: This decree sets out the general conditions for the granting, suspension and withdrawal of pesticide approval for any importer, exporter, trainer, reformer, repackager, distributor, reseller, applicator service provider, transporter and pesticide destroyer, pursuant to the provisions of Article 10 of Law No. 026-2017/AN of 15 May 2017 on the control of pesticide management in Burkina Faso.

National Programme for Integrated Water Resources Management 2016-2030 (PNGIRE): PNGIRE is a sectoral document of Burkina Faso whose main objective is to contribute sustainably to the satisfaction of the freshwater needs of users and aquatic systems. The Programme provides for actions to make agriculture, forests and fisheries more productive and sustainable. The Programme's provisions include reducing water regulatory violations; increasing financial resources for the protection of water resources; improve IWRM steering and management capacities; improve the competences and effectiveness of the management structures of the water agencies and the partners concerned; have reliable tools to help with decision-making; improve knowledge of water resources and related fields; sustainably preserve the quality of water resources for various uses; reduce losses in the quantities of water that can be mobilized; improve the consideration of

human rights in the management of water resources; and changing stakeholder behaviours regarding water protection and uses.

Decree N 2015-1189/PRESTRANS/PM/MERH/MEF of 22 October 2015 adopting the National Plan for Adaptation to Climate Change (PNA): This decree adopts the National Plan for Adaptation to Climate Change (NAP). The objectives of NAPs are to (i) reduce vulnerability to the impacts of climate change by developing adaptive and resilient capacities, (ii) facilitate the integration of climate change adaptation, in a coherent manner, into new or existing policies, programmes or activities, in specific development planning processes and strategies within relevant sectors and different levels.

Law No. 026-2007/AN of 20 November 2007 instituting fertilizer control in Burkina Faso: The law provides a control of import, export and locally manufactured fertilizers in Burkina Faso. The import of fertilizers into Burkina Faso is subject to obtaining a National Certificate of Conformity (CNC), issued by the Minister in charge of Trade, after the opinion of the Minister in charge of Agriculture. The import and marketing of fertilizers are subject to approval by the Minister for Trade, after consultation with the Minister for Agriculture. Every package containing fertilizer shall have an appropriate label showing in a legible manner the name and address of the manufacturer, the formula, the nutrient content and the net weight.

Nationally Determined Contribution (NDC) of Burkina Faso 2021 – 2025: In its updated NDC document published on October 2021, Burkina Faso has committed to reduce its GHG emissions by 31682.3 Gg CO2eq by 2030, i.e. 29.42% compared to the Business-As-Usual scenario. The country has raised its NDC by 11.22 % from 18.2%, the NDC set in 2015 during its first submission. The NDC highlights the option taken by the country of strengthening its adaptation and resilience through the implementation of actions with an estimated potential to reduce GHG emissions of 33072.72 Gg CO2eq or 30.76% compared to the Business-As-Usual scenario. This NDC covers the energy, Agriculture, Forestry and Other Land Use (AFOLU), waste and transport sectors for mitigation and agriculture, water, environment, animal resources, habitat and infrastructure for the adaptation sectors. The main greenhouse gases used for the purpose of the updated NDC are carbon dioxide (CO2), Nitrous Oxide (N2O) and Methane (CH4). Burkina Faso's NDC will face significant adaptation challenges that will hinder it implementation due to vulnerabilities of the country to the effects of climate change. The NDC targets key socio-economic sectors of development such as agriculture, livestock and fisheries which are highly susceptible to climate variability.

### 2.2.3 Regulatory Bodies

In Burkina Faso, the agricultural sector is led by the following ministries: Ministry of Agriculture, Animal Resources, and Fisheries, Ministry for Animal Resources and Fisheries and Ministry of Agriculture and Hydro-agricultural Development. The Ministry of Agriculture and Hydro-agricultural Development is further subdivided into central services, decentralised structures and general directorate that support in promotion of agricultural sector across the country. The ministries are established by ministerial decree that determines the structure, composition and responsibilities of the statutory body.

Ministry of Agriculture, Animal Resources, and Fisheries (MAAH): MAAH[2] oversees agricultural, livestock and fisheries activities in Burkina Faso with the main focus being on enhancing food security, promoting sustainable farming practices, and supporting the country's animal and fishery sectors.

[2] Ministry of Agriculture - [MAAH] Portal - Home page

Ministry for Animal Resources and Fisheries (MRAH): is responsible for the livestock sector, with the following functions: (i) traditional livestock support activities through training and extension for producers; (ii) development of pastoral areas, promotion of feed-processing industries, and support to fodder production, to spur intensive animal production; (iii) strengthening of animal health infrastructure and services; (iv) improvement of quality control of animal products; (v) support of the processing industries of livestock by-products: food products, hides and skins, and manure of animal origin; and (vi) identification of stable and remunerative markets for livestock products. The Ministry is established by Decree No. 2016-298/PRES/PM/MRAH of 29 April 2016 on the organisation of the Ministry of Animal and Fisheries Resources. This decree establishes the organization of the Ministry of Animal and Fisheries Resources (RMAH), which includes the following structures: the Minister's Office; and the General Secretariat.

Ministry of Agriculture and Hydro-agricultural Development[3]: The Ministry of Agriculture and Hydro-agricultural Management is responsible for the development, implementation and monitoring of government policy in the fields of agriculture, water management and food security. . Its main functions include policy formulation and implementation, provision of agricultural extension services, monitoring and evaluation of the agricultural services and allocating resources and budget for agricultural development projects. The central services of the Ministry are structured as follows: the National Society for the Management of Food Security Stocks (SONAGESS); the Société d'exploitation des phosphates du Burkina (SEPB); the National Society for Land Development and Rural Equipment (SONATER); the National Soil Bureau (BUNASOLS); the Matourkou Multipurpose Agricultural Centre (CAP/Matourkou); the National Agency for Rural Land (ANTR); and the Sourou Valley Development Authority (AMVS). The decentralised structures are the branches at the regional, provincial, departmental and sub-departmental levels. They are attached to the General Secretariat. The decentralised structures include the Regional Directorates of Agriculture and Hydraulic Development (DRAAH) subdivided into Provincial Directorates (DPAAH), Technical Support Zones (ZAT) and Technical Coordination Units (UAT); and Rural Promotion Centres (CPR). The DRAAH are headed by Regional Directors appointed by decree issued by the Council of Ministers. The General Directorates of the Ministry of Agriculture and Hydraulic Development are: the Directorate-General for Plant Production (DGPV); the General Directorate for the Promotion of the Rural Economy (DGPER); the General Directorate for Land, Training and Organisation of the Rural World (DGFOMR); the General Directorate of Hydraulic Development and Irrigation Development (DGAHDI). The general directorates are further subdivided into related structures.

Directorate-General for Plant Production (DGPV): It focuses on improving food security and increasing agricultural production. DGPV includes the following Directorates: the Directorate of Agricultural Inputs and Mechanization (DIMA);the Directorate for the Development of Agricultural Production (DDPA); the Directorate of Plant Protection and Packaging (DPVC); and the Directorate of Extension and Research and Development (DVRD).

Ministry of Agriculture, and Food Security: This is a statutory body established under the Decree 2013-612/PRES/PM/MASA of 23 July 2013 on the organisation of the Ministry of Agriculture and Food Security. This decree lays down the rules for the organization, powers and functioning of the Ministry of Agriculture and Food Security. The organization of this Ministry is organized around two structures, namely the Minister's Office; and the General Secretariat. This decree sets out the rules for the organization, attributions and functioning of the Ministry of Agriculture and Food Security. The Minister of Agriculture and Food Security is responsible for the implementation of the agricultural policies defined by the Government.

[3] Médiathèque - Ministère de l'Agriculture et des Aménagements Hydro-agricoles

**Ministry of Environment, Green Economy and Climate Change:** The organisation of this ministry is prescribed in the Decree No. 2016-383/ PRES/PM/MEEVCC of 20 May 2016 on the organization of the Ministry of the Environment, Green Economy and Climate Change. This Ministry comprises the following structures: the Minister's Office the Secretariat-General. The Minister's office includes the Director of Cabinet, the Technical Advisers, the Technical Inspectorate of Services, the Chargé de Mission, the Permanent Secretariat of the National Council for Sustainable Development, the National Authority for Radiation Protection and Nuclear Safety, the Special Secretariat, the Protocol, and the Safety of the Minister. As for the General Secretariat, it includes the services of the General Secretary; central structures; concentrated structures; the structures attached; mission structures.

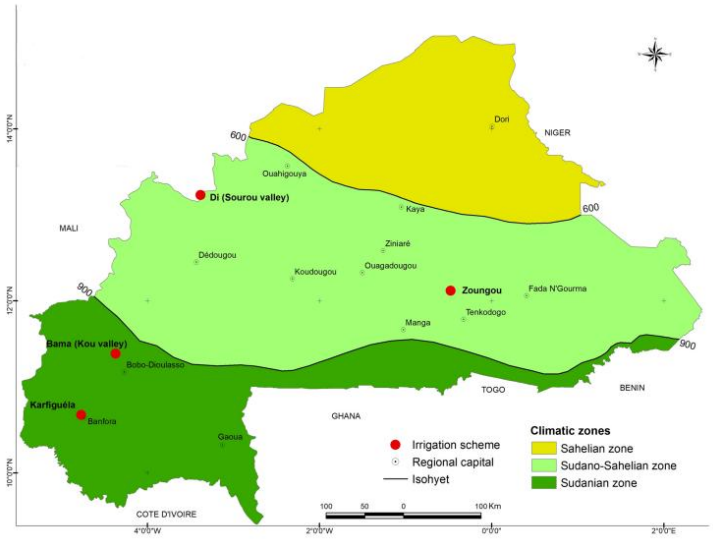
### 2.2.4 Emerging Regulation

Draft Constitution of Burkina Faso 2015: The constitution has been amended in 2015, often to promote and protect the personal interests of the ruling elites or the ruling party. However, a referendum on the constitution for the Fifth Republic was erroneously announced for March 24, 2019, but it has not been officially scheduled. Following a coup d'état in January 2022, the military deposed President Kaboré and dissolved the parliament, government, and constitution (Aljazeera , 2022). The amendments made include Article 14 concerning wealth and natural resources, which belong to the people. It is established that these resources are used for the improvement of their living conditions and in accordance with sustainable development.

## 2.3 ENVIRONMENTAL RISKS ANALYSIS

Crop production in northern Burkina Faso is highly vulnerable to climate variability and change, as it is primarily rain-dependent and limited by a short rainy season. Climate stressors that can negatively affect productivity in the zone include increased temperature, heat waves, evaporation, heavy rainfall, and dry periods **(USAID, 2017)**.

The study was conducted in Burkina Faso and covers a range of arid climatic conditions (Sudanese and Sudan-Sahelian zones) that occur in most Sahelian countries in West Africa and are highly vulnerable to the negative impacts of climate change. Burkina Faso is divided into the Sudanese zone (located above the isohyet 900 mm), the Sudanese-Sahelian zone (between the isohyets 600 and 900 mm), and the Sahelian zone (below the isohyet 600 mm) (Figure 7).




*Source: Johnson et al., 2023*

*Figure 2-7 Burkina Faso - Climatic zones delimitation*

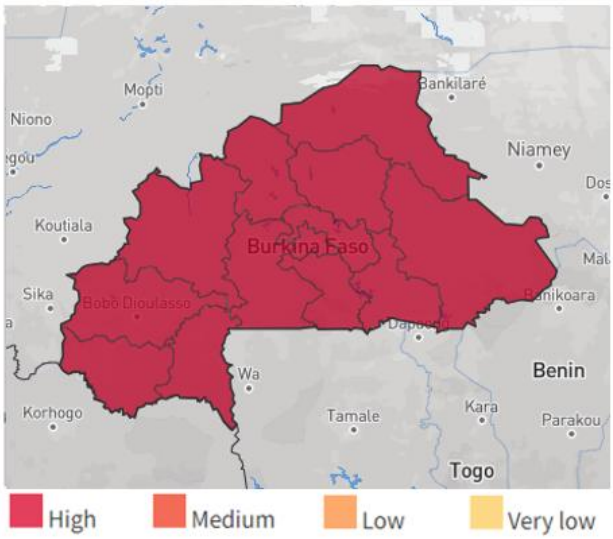
Each climatic zone is characterized by a unimodal rainfall regime and experiences distinct wet and dry seasons, with the rainy season lasting 5 months in the south and 2 months in the north. The country also experiences precipitation variability and increasing temperatures. The cultivated lands are characterized by low soil fertility, poor nutrient availability, and widespread soil degradation, as observed in most Sahelian countries. (Jean-Martial Johnson, 2023)

For example, a study published by Journal of Water & Climate Change in 2023 showed that Cowpea yields seem to be more affected by extreme cold (cool days and cold nights) in the Sudan and Sahel regions. In fact, a one-unit increase in cool days (daily cooling) within the Sudan region could reduce cowpea yields by 58.4 kg/ha. Conversely, a one-degree increase in the coldest night temperature (warming of the coldest night) and a 1% increase in the frequency of cold nights (night cooling) could reduce cowpea yields by 28.6 kg/ha and 56.2 kg/ha, respectively (Sanou, et al., 2023).

The results are consistent with those of (Dileep K. Panda, 2014) who confirmed that extreme day and night temperatures have a negative impact on important crops through changes in phenological development and physiological processes. Thus, cold days and nights are disadvantageous for cowpea production in the Sahel region of Sudan and Burkina Faso. Despite the increasing trend of hot weather extremes in each climatic zone, these extremes have not adversely affected cowpea production.

### 2.3.1 Water availability

In Burkina Faso, water scarcity is classified as high according to the information available on ThinkHazard[4]. This categorization indicates that droughts are expected to occur on average every five years. Given this frequency, the impact of drought must be considered throughout all phases of the agricultural value chain, particularly its effect on personnel and stakeholders. The current hazard level is likely to increase in the future because of climate change, making it crucial to adopt proactive measures.



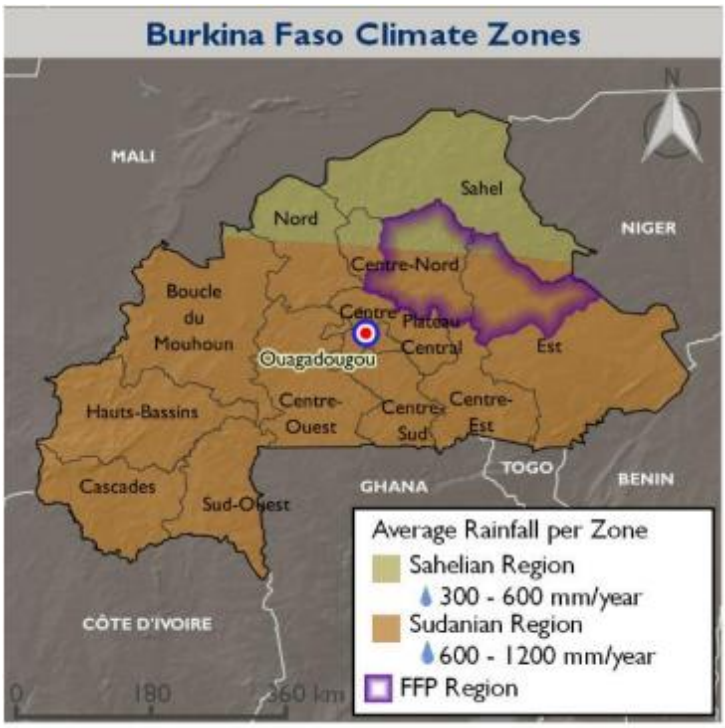

*Source: ThinkHazard!*

***Figure 2-8: Burkina Faso – Water Scarcity Level***

The lack of availability of water resources is a major concern. According to a 2017 UNEP report, it is exacerbated by low rainfall (about 1200 mm in the southwest and 300 mm in the Sahel per year), irregular and unevenly distributed. In addition, only 0.1% of the country's territory is covered. Despite the country's ongoing development, mobilization infrastructure remains insufficient and is often poorly maintained. In such a context, access to water is a daily struggle and source of conflicts between populations (Lankoandé, 2017).

In Northern Burkina Faso, the focus of USAID's Food for Peace (FFP) program (figure 8), is a semi-arid region suffering from chronic food insecurity. In this region, poverty, low precipitation, high evaporation rates, reliance on rain-fed agriculture, and poor soil quality make the people particularly vulnerable to climatic variations (droughts, floods, heat waves, and dust storms) that reduce agricultural production and drive-up food prices.

[4] Please refer to https://thinkhazard.org/en/report/133-kenya/DG.




*Source: USAID, 2017*

*Figure 2-9 Burkina Faso - Water availability per zone*

### 2.3.2 Land Degradation and Soil Erosion

The degradation of land resources is of particular concern. According to the Strategic Investment Framework for Sustainable Land Management, 9,234,500 ha of Burkinabe land, or 34% of the territory, is degraded for anthropogenic causes (agriculture, animals, tenures, wood energy) and climate. The annual increase in degraded land is between 105,000 and 250,000 ha (Lankoandé, 2017).

Poor resource management in the country and reduced rainfall have exacerbated land degradation. A rapidly growing population, coupled with high rates of internal rural migration and thirty years of desiccation, have resulted in profound land use and land cover change throughout the country's lands (Ilboudo-Nébié, 2020). The issue of soil erosion has been a major obstacle for sustained and integrated socio-economic development for farmers in Burkina Faso. This situation compelled them to develop Soil and Water Conservation measures (SWCM) purposely for runoff control, soil moisture improvement, land rehabilitation, and nutrient management. (Clement Nyamekye, 2018).

In Burkina Faso, two causes of soil erosion have been identified: natural and anthropogenic. Natural factors include water erosion and wind erosion (deflation), which is more prevalent in the Sahel region. Anthropogenic factors mainly include poor agricultural practices, such as overexploitation of agricultural land, mining and construction activities **(FAO, 2023)**.

### 2.3.3 Soil Fertility and Acidification

The National Burau of Soil (BUNASOLS) has identified nine soil classes in Burkina Faso. These soils are low in organic matter and phosphorus and have poorly developed structures. They have low agronomic value and most (more than 28%) have high acidity (pH 5.1-5.5). Of these soil types, the most common are:

- **Ferric and manganous oxide soils**: ferric soils are the main soils (40%) in the region. They have low fertility and low water retention. Important limitations: Depth is often limited by induration in the form of a hard crust and high sensitivity to erosion;
- **Poorly developed soils** cover about 26 percent of the territory. They are of medium depth and have limited organic and mineral fertility. They are of little interest for agriculture and livestock breeding. Main limitations: insufficient fertility and poorly developed structure; and
- **Hydrosoils** are deep soils and cover about 13 percent of the territory. They are found mainly in drainage networks. The texture is silty to clayey, and the water retention capacity is very good. Agronomic values are average. Main limitation: Smothered soils for low water demanding crops such as millet, sesame, fonio (a type of small foxtail millet).

### 2.3.4 Pesticides use

In Burkina Faso, pesticides are mainly used in agriculture to control pests, weeds and rodents. Although cotton is grown on only 5% of the arable land, it consumes more than 90% of all pesticides used in Burkina Faso. Moreover, tomatoes are also highly sensitive to pests. A study conducted in Ouagadougou, Burkina Faso, found that tomatoes sold in urban markets often contain pesticide residues. The most common pesticides detected in tomato samples were acetamiprid, chlorpyrifos, lambda-cyhalothrin, and DDT (Michel Dione, 2023), which are all considered Moderately hazardous (Class II) under controlled dosage (WHO, 2019).

Synthetic pesticides of all chemical classes are used in Burkina Faso; the most used pesticides are organochlorines (endosulfan), organophosphates (profenofos), pyridines (paraquat) and pyrethrinoids (cypermethrin) and carbamates (carbofuran) (all Class II). Pesticides belonging to the class Ia or Ib (such as carbofuran) are also used in Burkina Faso. As restrictions on their use are generally ignored thus not respected by farmers. (see table below)

*Table 2-1 Burkina Faso - Some Pesticides Ia and Ib (WHO classification) used in agriculture*

| Pesticides Ia | Pesticides Ib | Crop |
|---|---|---|
| | Cypermethrin-triazophos-diméthoate<br>Endosulfan<br>Cyfuthrin-chlorpyrifos<br>Deltamethrine- triazophos<br>Carbosulfan<br>Cypermethrin-métamidophos | Cotton |
| Carbofuran | | Sugar Cane |
| | Cyfuthrin-chlorpyrifos<br>Cyfuthrin- métamidophos | Tomato |

Source: Ouédraogo et al., 2011

No pesticides on the list of persistent organic pollutants (POPs) are used in Burkina Faso. However, this class of pesticide may still be used, as some pesticides are sold illegally and fraudulently in Burkina Faso. POPs are chemicals that persist in the environment, accumulate in high concentrations in fatty tissue, and are biomagnified through the food chain. POP chemicals can cause cancer and reproductive, immune, and developmental disorders (Moustapha Ouédraogo, 2011).

Use of banned active ingredients is not the only problem, Inappropriate use of pesticides in Burkina Faso poses a threat to human health and the environment, and an EPFL paper is the first to quantify the problem by analysing soil, water, sediment, vegetable and hair samples. In that context, it has been found that Small-scale farmers in Burkina Faso are not trained in the correct use of pesticides, exposing people and the environment to serious contamination risks. In 72% of cases, higher than recommended amounts of pesticides are sprayed on a given area, and in 56% of cases, the recommended spray concentrations are exceeded. As a result, water from around 30% of wells in agricultural areas is not safe for drinking and pesticide levels in 36% of vegetables do not meet international legal standards when it comes to maximum residue limits. Concentrations of endocrine disruptors and the presence of carcinogens pose a particular risk to people, especially children.

One possible explanation can be found on the labels of the products sold, which are often incomplete or in a foreign language – or non-existent. What's more, the illiteracy rate is high, and vendors often not trained on the appropriate use of the products they sell. As a result, it is common practice for the farmers to combine pesticides, as the researcher notes: "Some farmers mix the products they buy at the market and taste them, saying that the more it stings, the better it will work against parasites" (Lehmann, 2018).

### 2.3.5 Deforestation

The Government of Burkina Faso estimates that the country loses almost 110,000 hectares of forest each year. Causes of deforestation and forest degradation in Burkina Faso include agricultural expansion, overgrazing by livestock, wildfires, and the demand for firewood and charcoal. These factors include poor forest management and a growing rural population (Forest Carbon Partnership, 2024).

Between 1990 and 2000, Burkina Faso lost an average of 24,000 hectares of forest per year, corresponding to an average annual deforestation rate of 0.34%. Between 2000 and 2005, the rate of forest change increased between 3.5% and 0.35% per year. Overall, Burkina Faso lost 5.0% of its forest area, or about 360,000 hectares, between 1990 and 2005.

As measured by total habitat conversion rate (defined as the change in forest area and the change in forest area minus the net expansion of afforestation), Burkina Faso lost 2.8% of its forest and forest habitat between 1990 and 2005. (Mongabay, 2024). Burkina Faso has some 636 known species of amphibians, birds, mammals and reptiles according to figures from the World Conservation Monitoring Centre. Of these, 0.3% are endemic, meaning they exist in no other country, and 1.4% are threatened. Burkina Faso is home to more than 1100 species of vascular plants. 11.5% of Burkina Faso is protected under IUCN categories I-V (WorldRainForest , 2024).

### 2.3.6 Genetically Modified Crops

Burkina Faso was the first African country where a GM crop was principally grown by smallholder farmers. The crop was an insect resistant cotton variety, developed through a partnership with the company Monsanto (now Bayer Crop Science). At its height nearly 150,000 Burkinabè households grew GM cotton. Advocates believed that GM cotton could alleviate poverty and food insecurity by protecting crops from pests and increasing yields. Early studies reported increased average yields and incomes, creating a prominent narrative of success. However, there were significant variations among farmers, and some even lost money.

There are plans to introduce genetically modified cowpeas using the same pest-resistant Bt technology as cotton. Scientists have introduced the Bt gene into local cowpea varieties, making them resistant to the destructive cowpea borer. **(Gakpo, 2020)**.

In 2016, Burkina Faso abandoned GM cotton due to several reasons:

- **Shorter-Fiber Lint:** GM cotton had shorter-fiber lint, affecting the quality of harvested cotton.
- **Ginning Machine Issues:** Ginning machines extracted proportionally less lint from GM cotton bolls, resulting in losses of US$76 million for cotton companies.
- **Lower Yields:** New evidence showed that GM cotton yields were less than half of early projections **(The conversation , 2024)**.

## 2.4 SOCIAL RISKS ANALYSIS

### 2.4.1 Labour and Working Conditions

**Risks associated with small holder farming:** Smallholder farmers and labourers in Burkina Faso face challenging working conditions. They endure long hours of manual labour, often in extreme weather. This is especially true for rice and cowpea farmers during planting and harvesting seasons, which require intense physical effort. Many workers lack formal contracts and labour protections, leaving them with little job security and making them vulnerable to exploitation and unfair treatment by employers. The agricultural cycle for these crops is highly seasonal, leading to periods of high labour demand followed by times of underemployment. During the off-seasons, workers often struggle to find alternative sources of income, resulting in financial instability. This unpredictability makes it difficult for families to sustain themselves year-round, increasing poverty and food insecurity[5].

**Unions for maize and beans:** Many smallholder farmers and labourers are not members of unions or farmer organizations. This limits their ability to collectively bargain for better wages, working conditions, and access to resources. Increasing union membership could empower workers to negotiate more effectively with employers and government bodies.

**Migrant workers:** Burkina Faso relies significantly on both internal and international migrant workers to sustain its agricultural productivity. While specific numbers for the agricultural sector are not readily available, it is evident that a substantial portion of the workforce comprises migrant workers engaged in informal employment. This informal status makes precise tracking and data collection challenging (IOM, 2021).

Migrant workers in Burkina Faso have pathways to citizenship. According to Article 165 of the Persons and Family Code (1989), migrants can become citizens after at least 10 years of residence. This period is reduced to two years if the individual was born in Burkina Faso or has provided significant services to the country, such as notable contributions in the arts, sciences, or literature. Immediate naturalization is available for minors, adult children, spouses of foreigners, or stateless individuals who acquire Burkinabè nationality, and for those who provide exceptional services to Burkina Faso or whose naturalization is of exceptional interest to the country.

Burkina Faso has also a significant outflow of migrant workers, particularly within the West African region. The primary destinations for Burkinabe migrants include Côte d'Ivoire, Ghana, Mali, and Niger. Côte d'Ivoire remains the most popular due to its economic opportunities and geographical proximity. As of recent estimates, hundreds of thousands of Burkinabe migrants reside in Côte d'Ivoire, mainly working in the agricultural sector, such as in cocoa and coffee plantations. Burkinabe migrant workers often face challenges related to legal status and labour rights in their host countries. Many work informally and lack legal protections, making them vulnerable to exploitation, low wages, and poor working conditions. These conditions highlight the need for stronger legal frameworks and support systems for migrant workers abroad. To address these challenges, Burkina Faso has signed several bilateral agreements with neighbouring countries to protect the rights of its migrant workers and facilitate legal migration. These agreements aim to ensure fair treatment and provide a framework for addressing issues related to migration and labour rights:

[5] https://www.fao.org/agriculture/ippm/projects/burkina-faso/en/

- **Social Security Agreements**: Burkina Faso has agreements with several countries on the portability of social security benefits. For example, the 1961 agreement with Côte d'Ivoire and the 1969 agreement with Mali ensure that migrants benefit from social security under the same conditions as nationals.
- **Employment and Welfare**: Burkina Faso has also signed inter-agency social welfare payment agreements with retirement, social welfare, and social security structures in countries such as Mali (2000), Benin (2001), Senegal (2001), Togo (2001), Niger (2004), Côte d'Ivoire (2007 and 2009), and Gabon (2019) (IOM, 2021).

Occupational health and safety risks: Agricultural workers in Burkina Faso, including those involved in rice and cowpea farming, face significant occupational health and safety risks. The widespread use of pesticides and fertilizers without proper safety measures or training exposes them to severe health hazards, including respiratory issues, skin irritations, and poisoning. Many workers lack protective equipment and the necessary training to handle these chemicals safely, increasing the risk of contamination to both individuals and the environment. The physical demands of agricultural work are considerable, involving long hours of manual labour such as planting, weeding, and harvesting under extreme weather conditions. This can lead to musculoskeletal injuries and chronic pain. Additionally, outdated and poorly maintained machinery, when used, raises the likelihood of accidents. Workers are also at risk of heat stress and dehydration due to prolonged exposure to high temperatures (ILO, 2011).

### 2.4.2 Child Labour

With over three-quarters of youth employment, the agricultural sector remains the primary source of jobs for young people in Burkina Faso. Half of the young workers in this sector (approximately 77% of the youth) live in poverty. Unemployment and underemployment particularly affect young people (aged 15-35), with 82% of them being unemployed. They constitute 61% of the working-age population in Burkina Faso. Most of these young people are unpaid family workers and often lack the necessary or appropriate skills (ILO, 2014). Factors Contributing to Child Labour in the country are:

- Poverty: The high poverty rate among agricultural families forces many children to work to support their households. Families rely on the additional income generated by their children to meet basic needs, perpetuating the cycle of poverty and limiting educational opportunities for these children.
- Lack of Access to Education: In many rural areas, access to quality education is limited. Schools are often far from villages, and educational resources are inadequate. Consequently, children are more likely to be engaged in agricultural work rather than attending school.
- Cultural Norms: In some communities, child labour is culturally accepted as a norm. Children are expected to contribute to the family's livelihood from a young age, which is seen as a way of imparting agricultural skills and knowledge.

Burkina Faso has committed to international standards regarding child labour by ratifying key conventions, including Convention No. 138 on the Minimum Age for Admission to Employment and Convention No. 182 on the Worst Forms of Child Labour. The country has established the minimum age for employment and compulsory schooling at 16 years, with provisions allowing light work for children aged 13 and older. Since 2009, Burkina Faso has maintained a list of hazardous work prohibited for children, which underwent revision in 2016 to strengthen protections and ensure safer conditions for minors. Despite these efforts, eradicating child labour, particularly in the agricultural sector, remains a significant challenge in Burkina Faso. Child labour is prevalent in rural households across various profiles and livelihoods. A 2018 study on child labour in cotton-producing areas revealed that 46.7% of children aged 5-17 in these regions are engaged in child labour, with 25.7% involved in hazardous work. The incidence of hazardous work increases with age: 21.7% for children aged 5-12, 32% for

those aged 13-15, and 47.6% for those aged 16-17. These figures highlight the persistent and pervasive nature of child labour in rural agricultural communities.

### 2.4.3 Forced Labour

Burkina Faso is dedicated to combating forced labour, having ratified ILO Conventions No. 29 (on forced labour) and No. 105 (on the abolition of forced labour). The country has also signed various international and regional conventions aimed at preventing human trafficking. This commitment is enshrined in the Constitution and reinforced by a comprehensive legal framework, including the Labour Code of 2008 and Law No. 029-2008/AN on combating trafficking in persons and related practices.

Studies have shown that forced labour remains a very marginal practice in cotton production. Similarly, there is no substantial evidence to suggest that forced labour is prevalent in the production of rice and cowpeas. However, it is challenging to assert that forced labour is entirely absent from these sectors, as such practices can be concealed, particularly within family-based farming operations (ILO, 2023).

### 2.4.4 Access to Land and Land Tenure

As stated above, a vast majority of Burkina Faso's population resides in rural areas, heavily reliant on agriculture for their livelihoods. However, most agricultural land is neither registered nor legally recognized, posing a significant threat to farmers' land use rights and their overall economic stability. This issue is becoming increasingly pressing due to rising land demand driven by population growth and the emergence of new stakeholders, such as agricultural investors, gold miners, and real estate developers.

To address this, Burkina Faso enacted Law 034/2009 on "rural land tenure," establishing a legal framework to regulate land registration and security procedures. Despite this, the implementation of the law has been inconsistent. The bodies intended to oversee these processes often do not exist or are non-functional, particularly at the communal and village levels. Additionally, there is a general lack of awareness among the population about the importance of registering and legalizing land rights. Traditional land tenure systems also disadvantage certain groups, including women, migrants, and youth, limiting their long-term access to land. This insecurity and lack of prospects make it challenging for these groups to achieve self-reliance and deter them from investing in agricultural improvements (GIZ, 2021).

### 2.4.5 Community Health and Safety

The agricultural sector in Burkina Faso faces numerous health and safety challenges that impact both workers and the broader community. Between Health Risks, the use of pesticides in agriculture poses serious health risks to farmers and their families. Without proper training and protective equipment, exposure to these chemicals can lead to acute poisoning, long-term health issues such as respiratory problems, and even chronic diseases like cancer. According to the WHO, improper handling and application of pesticides are major concerns in developing countries, including Burkina Faso.

Water Contamination is another source of health issue related to Burkina Faso. Agricultural activities can contaminate water sources through runoff that carries pesticides, fertilizers, and animal waste. This contamination affects drinking water supplies and can lead to waterborne diseases, significantly impacting community health. Efforts to manage and protect water resources are critical to mitigating these risks. Finally, Poor Sanitation and Hygiene conditions can also exacerbate health

problems. Farmers and their families often live in conditions where access to clean water and sanitation is limited, increasing the prevalence of diseases such as diarrhoea, cholera, and other infections.

Additionally, social risks in the agricultural sector are heightened due to terrorism. The persistent threat of violence forces farmers to abandon their fields, leading to reduced agricultural productivity and food insecurity. The fear and instability affect not only the physical safety of the communities but also their mental well-being. Farmers have been compelled to form cooperatives, share resources, and adopt innovative techniques like agroforestry to mitigate these risks. However, the disruption of traditional agricultural practices and the constant threat to their livelihood continue to challenge the resilience of these communities.

## 2.5 GENERAL E&S RISK CONSIDERATIONS IN FL-RS INTERVENTION IMPLEMENTATION

The deployment of Food Loss Reduction Solutions (FL-RS) in Burkina Faso, particularly at the smallholder farm level, is likely to have significant implications for the key risk areas identified in the country profile.

Land Degradation: The use of physical FL-RS interventions, such as hermetic storage technologies and storage protectants of biological origin, may help mitigate the effects of land degradation by reducing the need for excessive use of chemical pesticides, which contribute to soil acidification and loss of fertility. Additionally, the introduction of moisture meters and proper training on post-harvest techniques can help reduce crop losses and improve soil management practices, indirectly contributing to better land stewardship.

Labour Conditions: Training and capacity-building efforts focused on post-harvest techniques and the correct use of FL-RS technologies will likely improve working conditions for smallholder farmers. By enhancing their skills and knowledge, Additionally, the communal use of advanced machinery can reduce the labour intensity of farming activities, improving overall labour conditions.

Child and Forced Labour: The project's emphasis on training and the introduction of labour-saving technologies could indirectly reduce the prevalence of child and forced labour. By increasing productivity and efficiency, the need for child labour may decrease as families can achieve the same or greater outputs with less labour input. Furthermore, improved financial access to machinery and the establishment of farmer organizations could create economic incentives that diminish reliance on child labour.

Regional conflicts: In Burkina Faso, regional conflicts, add significant challenges to the implementation of FL-RS interventions. These conflicts increase risks to the safety of AGRA staff and partners, make it harder to deliver and set up FL-RS technologies, and can strain relationships within communities. Additionally, finding suitable partners and working with local governments in these conflict zones can be difficult and may impact the success of the Programme.

# 3 Ethiopia

## INTRODUCTION

**Agriculture is the cornerstone of Ethiopia's economy, accounting for 40% of the GDP and employing 75% of the workforce.** Dominated by smallholder farming, which produces over 95% of the agricultural output, the sector faces challenges like fragmented land and low yields (ITA, 2024). Rapid population growth, urbanization, and infrastructure investments are transforming the agricultural market, increasing integration and raising the prices of high-quality commodities. Within the sector, wheat and teff are crucial crops, with wheat being a staple that still requires imports to meet demand, and teff, a key dietary staple, providing significant income to farmers. Despite accounting for 84% of exports, Ethiopia remains a net importer of agricultural products, highlighting both challenges and opportunities in the sector. Addressing constraints like limited access to finance and technology, and improving market systems and research, are essential for realizing Ethiopia's agricultural potential.

**Ethiopia's agricultural policy framework is comprehensive and forward-thinking (see section 2.2), aiming to integrate climate change adaptation and promote sustainable development.** Key strategies such as the Climate Resilient Green Economy (CRGE) strategy and the National Adaptation Plan (NAP-ETH) focus on building a climate-resilient economy. The Postharvest Management Strategy and Agricultural Extension Strategy emphasize reducing post-harvest losses and transforming agriculture through innovative extension services. The Long-Term Low Emissions and Climate Resilient Development Strategy (LT-LEDS) outlines a roadmap for decarbonization and resilience, while the Seed System Development Strategy aims to improve seed production and distribution. While these policies are ambitious and well-structured, their successful implementation will require robust institutional support, adequate funding, and effective coordination among stakeholders.

**Ethiopia faces significant environmental risks, particularly in water availability, land degradation, soil fertility, pesticide use, deforestation, and the adoption of genetically modified crops**. Despite having 12 river basins with substantial water resources, the country struggles with water scarcity due to inadequate infrastructure and variable precipitation. Droughts have severely impacted agricultural productivity, particularly for crops like sorghum, wheat, and rice (Seleshi Bekele Awulachew, 2007). Land degradation affects over 85% of Ethiopia's land, leading to reduced soil fertility and agricultural yields (Tadesse & Hailu, 2024). Soil acidification and nutrient depletion further threaten crop productivity, while pesticide use, though lower compared to other countries, poses health and environmental risks due to limited awareness and improper practices. Deforestation, driven by agricultural expansion and logging, exacerbates soil erosion and climate change impacts.

**Ethiopia has begun to explore genetically modified crops like BT-cotton and gene-edited teff to improve yields and pest resistance.** Addressing these environmental risks requires integrated and sustainable approaches to ensure the long-term viability of Ethiopia's agricultural sector. Finally, also social risks in Ethiopia's agricultural sector are significant and multifaceted, encompassing labour conditions, child labour, forced labour, land tenure, land fragmentation, and community health and safety. Smallholder farmers, who dominate the sector, face challenges such as delayed input delivery, lack of credit markets, and limited access to agricultural technology. Migrant workers are exposed to poor working conditions and health risks like malaria (Diriba, 2020). The adoption of mechanization is minimal, hindered by socioeconomic factors, land tenure issues, and lack of knowledge. Child labour remains prevalent, particularly in rural areas, despite national and international legislative efforts to protect children. Forced labour and human trafficking are pressing issues, with many

Ethiopians exploited in various sectors due to poverty and lack of income. Land tenure insecurity discourages investment in long-term crops, and land fragmentation reduces arable land availability, impacting food security. Hazardous chemical use in agriculture poses significant health risks to farmers and communities, exacerbated by improper handling and application practices.

## LIST OF ACRONYMS

| | |
|---|---|
| ACC | Agricultural Commercialization Clusters |
| APHRD | Animal and Plant Health Regulatory Directorate |
| ATA | Agricultural Transformation Agency |
| BoAs | Bureaus of Agriculture |
| CBD | Convention of Biological Diversity |
| CR | Climate Resilience |
| CRGE | Climate Resilient Green Economy |
| CSA | Central Statistical Agency |
| DDG | Deputy Director General |
| EARCS | Ethiopian Agricultural Research Council Secretariat |
| EBI | Ethiopian Biodiversity Institute |
| EBIR | Institute of Biodiversity Conservation and Research |
| EFSRA | Ethiopia Food Security Reserve Administration |
| EIAR | Ethiopian Institute of Agricultural Research |
| FDRE | Federal Democratic Republic of Ethiopia |
| GDP | Gross Domestic Product |
| GE | Green Economy |
| HLI | Higher Learning Institutes |
| IBC | Institute of Biodiversity Conservation |
| ILO | International Labour Organization |
| ISPD | Institutional Strategic Partnerships Directorate |
| LFSDP | Livestock and Fisheries Sector Development Project |
| LT-LEDS | Long-Term Low Emissions and Climate Resilient Development Strategy |
| MoA | Ministry of Agriculture |
| NAP-ETH | National Adaptation Plan |
| NARS | Natural Resource National agricultural research system |
| NDC | Nationally Determined Contributions |
| NBP | National Biodiversity Platform |
| NCLS | National Child Labour Survey |
| NDC | Nationally Determined Contributions |
| NZE | Net Zero Emissions |
| PHL | Post Harvesting Loses |
| RARIs | Regional Agricultural Research Institutions |
| RCBED | Research Capacity Building Enhancement Directorate |
| RCCD | Research Centers Coordination Directorate |
| RSCO | Research System Coordination Office |
| SSA | Sub-Saharan Africa |

| | |
|---|---|
| UN | United Nations |
| UNDESA | United Nations Department of Economic and Social Affairs |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USAID | United States Agency for International Development |

## 3.1 PILLARS OF ETHIOPIA'S AGRICULTURAL SECTOR: FOCUS ON WHEAT AND TEFF

### 3.1.1 The Agricultural Economic Landscape

Market overview

Agriculture is the primary driver of economic growth in Ethiopia, accounting for 40% of the country's GDP. This makes it one of the largest components of the economy. Crop and livestock production contribute approximately 65% and 25% to agricultural GDP, respectively (ITA, 2024). Additionally, about 75% of Ethiopia's workforce is employed in the agriculture sector (ModorIntelligence, 2024). The rapid growth of agricultural commodity supply chains is becoming an increasing source of employment in the country. Improved inputs, enhanced management practices, and the expansion of irrigated agriculture can significantly boost crop yields. However, several constraints, such as limited access to finance and technology, impede potential gains. Furthermore, inefficient market systems and underdeveloped research and advisory services pose additional challenges.

Ethiopia's agricultural commodity market is evolving rapidly due to significant contextual changes, including strong population growth, rapid urbanization, large infrastructure investments, rising incomes, changing dietary habits, and policy reforms. While agricultural commodity markets are becoming more integrated, and marketing margins and seasonal price fluctuations have decreased over time, the prices of nutritious, high-quality agricultural commodities have increased. This trend contrasts with the prices of staple agricultural goods such as cereals (Fantu Cheru (ed.), 2019)

Dominant farming practices:

- Smallholder Farming:

In Ethiopia, about 60% of farmers cultivate in highly fragmented landscapes of less than 0.9 hectares. However, smallholder agriculture is responsible for the majority of Ethiopia's food production; it cultivates more than 90% of the total cultivated land area and provides over 95 % of the annual gross total agricultural output of the country. Smallholder farmers generally grow cereals such as teff (*Eragrostis tef [Zucc.] Trotter*), maize (*Zea mays*), wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), and sorghum (*Sorghum bicolor*). Crop yields on smallholder farms are very low compared to their production potential and are significantly lower than the yields achieved on experimental farms and research stations (less than 50%). Particularly noteworthy is the disparity in maize, with an average yield of 2.6 t/ha compared to the potential yield of 7.8 t/ha achieved in agricultural trials. Low crop yields have implications for food security, as large amounts of grain must be imported. For example, in the past, 30-50% of the wheat consumed in the country was imported because domestic production was too low (Gebeyanesh Zerssa O. F.-G.-L., 2021).

- Large-Scale Commercial Agriculture:

This sub-sector refers to the farms that include state and private commercial farms mainly established for the purpose of profit making by selling agricultural products at local market and/or abroad. These farms are commonly owned and operated by government, private companies and non-governmental institutions, such as private individual investors, shareholders, religious and non- religious institutions etc. Commercial farms are not widely spread, hence the contribution of these farms to the country’s gross total agricultural output is limited only to about 5%.

Source: cdkn, 2017
*Figure 3-1 Ethiopian farmer*

The major cash crops grown in Ethiopia are:

- **Teff**: Teff is a stable food and the biggest cash crop in Ethiopia according to (Jagdish, 2021).
- **Coffee**: Ethiopia is renowned for its high-quality coffee. It's both a major export and a significant part of local consumption. The country exports around 200,000 to 250,000 metric tons of coffee annually. Locally, coffee is an integral part of Ethiopian culture, with traditional coffee ceremonies being common. About 98% of the coffee was produced by smallholder farms of less than a hectare, and the remaining 2% by state farms.
- **Wheat**: wheat is among the most important crops grown in Ethiopia, both as a source of food for consumers and as a source of income for farmers (Minot Nicholas, 2015).
- **Pulses** (Beans): Pulses, including various types of beans, are essential for both domestic consumption and export. Ethiopia produces substantial quantities of lentils, chickpeas, and other pulses.
- **Flowers**: Ethiopia's flower industry has become a new source for export revenue. The industry started in 2004, when the government made a massive push for foreign investments by establishing a presence at major international floricultural events. Since that, export earnings from this sector have grown to about 67.27 million US$ in 2006–07.
- **Sugarcane**: Ethiopia produces sugarcane for both local consumption and export. The country has several sugar factories that process sugarcane into sugar and other related products.
- **Cotton**: during the 2019 campaign, cotton exports were at 2,000 Mt. Emerging local markets and small export margins suggest that future exports will remain small (Ababa, 2019).
- **Oilseeds**: Oilseeds like sesame and Niger seeds are crucial for Ethiopia's economy. They are exported to international markets, particularly to China and India. Locally, oilseeds are used for cooking and as a source of edible oil. In 2006–2007, (the latest year available) exports of oilseeds accounted for 3.34 million US$, and pulses accounted for approximately 1.25 million US$ (International Monetary Fund, 2007).

Moreover, cereals (such as Maize, wheat, and barley), Potatoes and other vegetables (including onions, tomatoes, and carrots) serve as both a staple food and a cash crop. While some are exported, the majority are consumed domestically.
Out of the total grain crop area, 81.39% (10,358,890.13 hectares) was under cereals. Teff, maize, sorghum and wheat took up 24.17% (about 3,076,595.02 hectares), 18.60% (about 2,367,797.39 hectares), 14.38% (1,829,662.39 hectares) and 13.73% (1,747,939.31 hectares) of the grain crop area, respectively. As to production, the tables paint similar picture as that of the area. Cereals contributed 87.97% (about 277,638,380.98 quintals) of the grain production. Maize, teff, wheat and

sorghum made up 30.08% (about 95M quintals), 17.12% (54M quintals), 15.33% (48M quintals) and 15.92% (50M quintals) of the grain production, in the same order (ADDIS ABABA, 2019).

Internal-Export dynamics

Agriculture accounts for 84% of Ethiopia's total exports. And despite its' great potential, Ethiopia remains a net importer of agricultural products. Ethiopia is also a net importer of agricultural and food commodities, imported more than 3.68 billion US$ in agricultural and food products in 2022, an increase of five percent from the previous year. The top commodities imported were:

- **Palm oil** (910 million US$)
- **Wheat** (524 million US$)
- **Cane sugar** (486 million US$)
- **Rice** (458 million US$): on that note, the Ethiopian rice market is increasingly more dependent on Indian rice imports. As over 90% of both broken and milled rice imports to Ethiopia come from India. (FAC ICE Team - APRA blog, FAC blog, 2022)
- **Sunflower seed oil** (453 million US$).446

On the other hand, Ethiopia's total agricultural exports in 2022 were valued at 3 billion US$. Major exports include:

- **Coffee** (1.56 billion US$)
- **Fresh-cut flowers** (607 million US$)
- **Fresh vegetables** (254 million US$)
- **Sesame seeds** (188 million US$)
- **Pulses** (140 million US$). (International Trade Administration, 2024)

Ethiopia's agri-food trade balance of -478 million US$s indicates that the country's imports of agricultural and food products exceed its exports by that amount. In other words: Ethiopia earned less revenue from exporting agricultural goods and food products (e.g., coffee, flowers, vegetables) than it spent on importing items like palm oil, wheat, and sugar. The negative value signifies a trade deficit in the agri-food sector, which can impact the country's overall economic stability. (European Commission, 2024) Ethiopia's trade market is impacted by numerous factors:

- **Subsistence Orientation and Low Productivity:** Agricultural production in Ethiopia is often subsistence-oriented, leading to low productivity. Limited access to modern technology and inputs hinders efficiency and growth (Bekabil, 2014).
- **Land right and Autonomy Issues:** Land allocation, compensation and relocation pose challenges to local agricultural production.
- **Infrastructure and Market Constraints:** Poor infrastructure makes it expensive to transport goods to markets. Moreover, Inefficient market systems hinder trade and limit export opportunities (Wendimu, 2021).

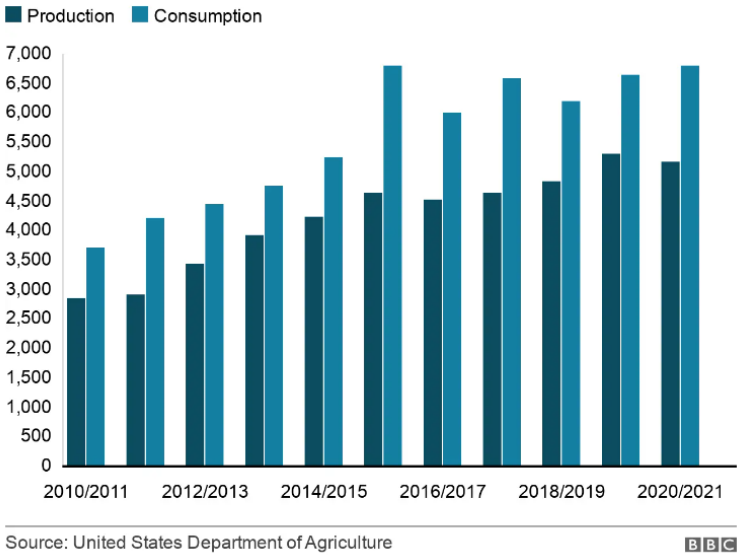
### 3.1.2 Wheat Crop overview

In Ethiopia, wheat (*Tiriticum aestivum*) ranks second after maize (*Zea Mays L.*) in total production and third after teff and maize in area cultivated. Wheat contributes about 15% of the national calorie intake. Ethiopia was ranked first right before South Africa in wheat production in sub-Saharan Africa (SSA). However, its average productivity of 2.4 t ha-1 is lower than the 6.7 t ha-1, 3.5 t ha-1, and 3.0 t ha-1 that was reported in Egypt, South Africa, and Kenya, respectively. Ethiopia still imports

wheat to meet growing local demand due to population growth, emergence of agro-processors, urbanization, and rising household incomes **(Yared Belete, 2022)**.

## Market analysis

Ethiopia was the largest wheat producer in Sub-Saharan Africa but still failed to meet domestic demands (see figure below). Domestic annual production of approximately 7.5 million metric tons accounts for about 75% of domestic wheat consumption. The GOE is increasing investments to expand irrigated wheat production to meet domestic demands and generate exports. In 2019, the Ethiopian government implemented structural, economic, and sectorial reforms, with wheat identified as a strategic commodity. (International Trade Administration, 2024) The Ethiopian government has made plans to replace wheat imports with local production to cease the dependence on imports. To this end, irrigation farming techniques are being introduced that allow wheat to be harvested twice a year.



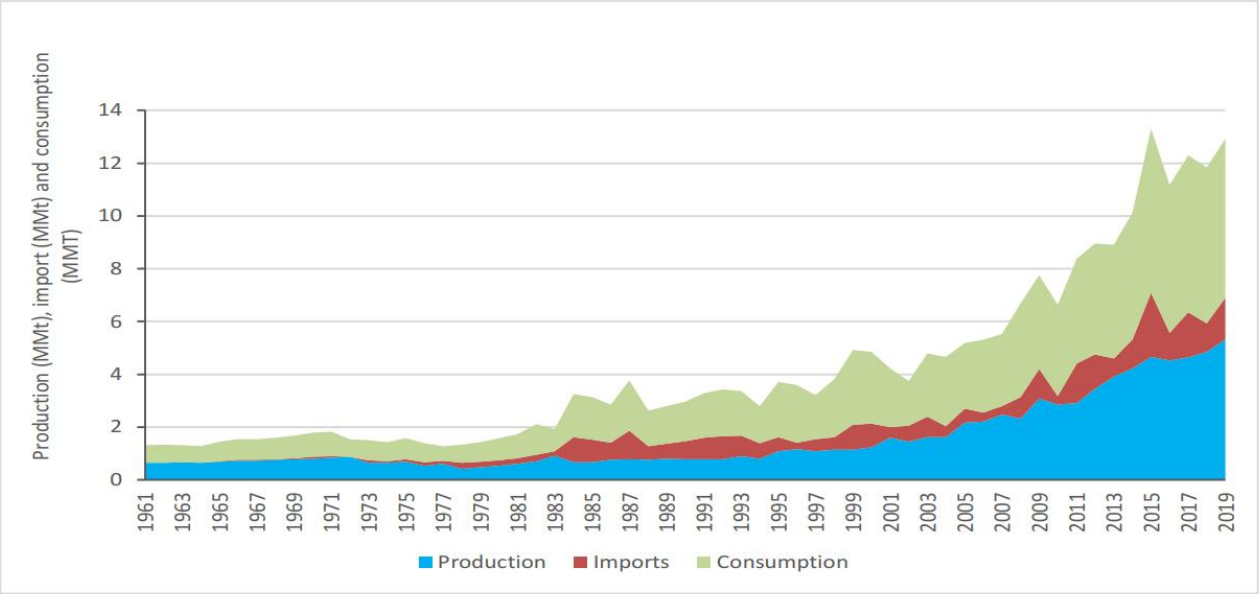

Source: USDA, 2022

***Figure 3-2: Ethiopia's' wheat production and consumption (1000 tons)***

In 2021, Ethiopia exported wheat worth 752k US$, with top export destinations being Norway and Angola. (OEC, 2022) Ethiopia imported wheat worth 952 million US$ in 2021, mostly from Ukraine, the United States, Russia, Romania and Bulgaria. Ethiopia has the capacity to export over 32 million quintals of wheat after meeting domestic consumption according to Wheat Export National Committee Coordinator Ambassador Girma Birru statement on 16th of February 2023. Ethiopia officially launched its National Wheat Export Program to neighbouring countries Djibouti and Kenya in the same month (New Business, 2023).

As indicated in the production and consumption trend analysis below (see figure bellow), the demand for wheat in Ethiopia has been increasing over the years because of rapid population growth and urbanization which necessitated change in food

preferences which are easy and fast to prepare such as bread, biscuits, pasta, noodles and porridge from the wheat flour (Wuletaw Tadesse, 2022).




Source : Wuletaw Tadesse, 2022

***Figure 3-3: Wheat production, consumption and imports in Ethiopia from 1960–2020***

***Table 3-1 Wheat total market size in Ethiopia***

| Wheat Total Market Size (1000 MT) | | | | |
|---|---|---|---|---|
| | 2021 | 2022 | 2023 (Estimate) | 2024 (Estimate) |
| Total Local Production | 5,479 | 5,520 | 7,000 | 7,500 |
| Total exports | 0 | 1 | 0 | 10 |
| Total imports | 1,400 | 1,700 | 900 | 600 |
| Total market size* | 6,879 | 7,219 | 7,900 | 8,090 |
| *Total market size= (Total Local Production + Imports) – Exports | | | | |

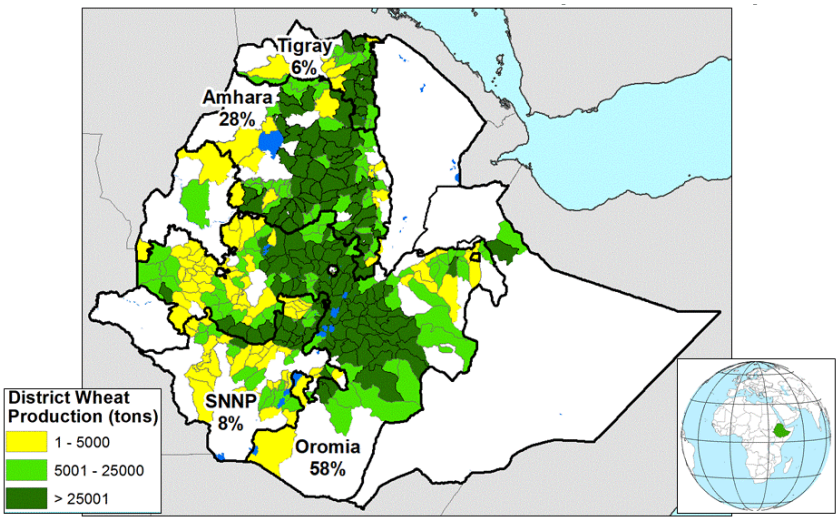
Source: International Trade Administration, 2024

<u>Dominant farming practices and value chain:</u> Wheat cultivation in Ethiopia has traditionally been in the highlands and is rain dependent. It combines both traditional and modern practices. The government promotes "cluster farming" and mechanization and subsidizes and distributes inputs such as fertilizer and high-quality seeds. National wheat production is found in Oromia, Amhara, SNNP (Southern Nations, Nationalities, and Peoples) and Tigray.

Ethiopia is the largest wheat producer in Sub-Saharan Africa, with most wheat grown in the Oromia region. Smallholders, with average landholdings of less than 1 hectare, produce the majority of wheat. Both bread and durum wheat are cultivated in Ethiopia. The tetraploid wheat (durum and emmer wheat, Triticum turgidum, AABB) have been dominantly cultivated in Ethiopia for thousands of years and there have been diverse collections of landraces stored in the Ethiopian national gene bank and other gene banks (Gatersleben, Germany, CIMMYT, ICARDA, USAID etc.). Although seed distribution remains largely informal. For emergencies, 60% of grain stocks are held by the Ethiopia Food Security Reserve Administration (EFSRA).

As for milling, Ethiopia has about 207 flour mills with a total production capacity of 3.2 million tons of flour a year. Which were at half capacity in 2012. Most farmers sell wheat within their district. 51% sold to wholesalers, 43% to retailers and only 6% to consumers (Kathryn Bergh, et al., 2012).

Regional focus areas: The major wheat producing areas in Ethiopia include Bale and Arsi (situated in Oromia Region), Hadiya and Kenbata (Southern Nations and Nationalities and Peoples Region) and East Gojam and North Shoa (Amhara Region) As Oromia contributes with the largest share of 58%, Amhara with 28%, SNNP with 8% and Tigray with 6% of total production.




Source: Foreign Agricultural Service , 2024

*Figure 3-4: Ethiopia - Regional wheat production*

### 3.1.3 Teff Crop overview

Teff is a tiny, round, khaki- colored grain, that is native to Ethiopia and is the most common cereal crop (see figure bellow) used to make injera **(Department of Nutrition and Food Service, 2010)**. Teff provides two-thirds of the daily protein intake in the Ethiopian diet. It is also used as fodder for livestock and as building material **(Food and Agriculture Organisation, 2024)**.

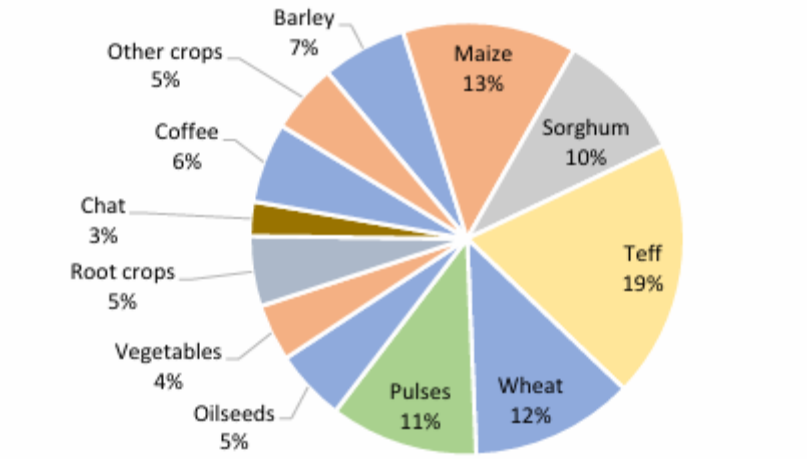
According to teff breeders at Debre Zeit Agricultural Research Centre, the main problem with teff is lodging. This has not yet been solved. Because teff is indigenous to Ethiopia, the available gene pool is limited, and there is not enough variability to identify varieties resistant to lodging. Lodging affects both the quantity and quality of yield. It also interferes with harvesting (whether manual or mechanical). Other problems include abiotic stresses, especially drought, cold/frost in the Highlands, and acidity.

About 20 improved varieties of teff have been officially released**.** The most popular improved varieties are Quncho (mid-altitude), Cross (Lowlands) and Dega (Highlands). An analysis of the teff value chain in 2012 found that 76% of growers had adopted Quncho. Quncho was released for mid-altitude areas. In Gojam (western Amhara) all farmers grow Quncho, but they will combine it with local teff varieties. Quncho is regarded as unsuitable for regions like Oromia (below 1,600 metres above sea level) and is not widely grown there (Alastair Orr, 2017).

Market analysis: In Ethiopia, teff is an important staple food. It is the most important crop in terms of cultivated area and production value.

As of 2017, teff covered about 24% of the country's cereal-cultivated area, and almost half of smallholder farmers cultivated teff between 2004 and 2014. It is therefore the most important cereal crop in Ethiopia in terms of agricultural land use and total production value. It has adapted to a wide range of environments and is currently grown under a variety of agro-climatic conditions. The crop is vital to the country's income and food and nutrition security and is grown by 6.5 million smallholder farmers.

According to the Food and Agriculture Organization of the United Nations, teff is the only cereal grain in which Ethiopia has a comparative trade advantage. It is the most important cereal in Ethiopia in terms of area planted and production value, and the second most important income-generating cereal (after coffee). It generates about 513 million US$ in annual income for local farmers. Studies show that injera exports reached about 10.27 million US$ in 2015. Teff's commercial surplus is equal to the commercial surpluses of the other three major cereals (sorghum, maize, and wheat) combined. Teff is also an economically superior product in Ethiopia. Its market price is often two to three times higher than that of maize, the country's largest product, making teff an important source of income for farmers. In fact, urban households are more likely to eat teff than rural households. Urban consumers consume 81 kg of teff per year, more than three times the consumption of their rural poor counterparts. This is partly due to the high price of teff compared to other crops, the urban affluent consumers consume relatively more teff than the rural poor (Yared Belete, 2022).




*Source: Fantu Nisrane Bachewe, 2015*

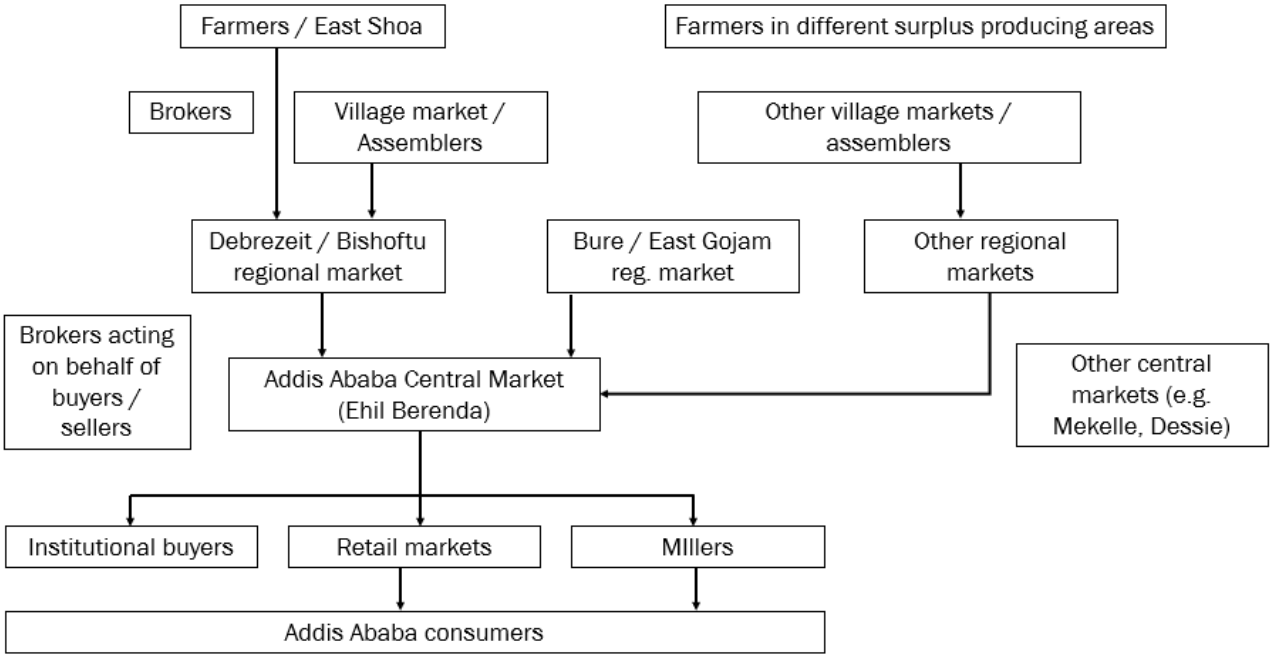
***Figure 3-5: Composition of the real value of crop output, 2004/5-2013/14 average, %***

<u>Dominant farming practices and value chain</u>:

Teff (*Eragrostis teff*) Teff is a cool climate crop grown primarily in the Ethiopian highlands, at an optimal location between 1,800 and 2,200 meters above sea level. Native to Ethiopia, it is the staple food of many Ethiopians and produces flour for injera, an unleavened bread eaten in the country's highlands and urban centres. However, teff is a very delicate and fragile crop that requires a lot of labour and care and has one of the lowest yields of the cereals grown in the country. Teff production requires large amounts of external inputs, especially fertilizers and herbicides (Ahmed, 1995).

The teff value chain in Ethiopia begins with farmers in surplus-producing areas. These farmers have national assembly and aggregation points, primarily located in Debrezeit/Bishoftu and Bure/East Gojjam, but there are other smaller ones as well. At these points, brokers facilitate transactions between the sellers (farmers) and the buyers. Subsequently, these facilitators transport the produce to the Central Market in Addis Ababa, where they resell it to retailers and institutional buyers (such as

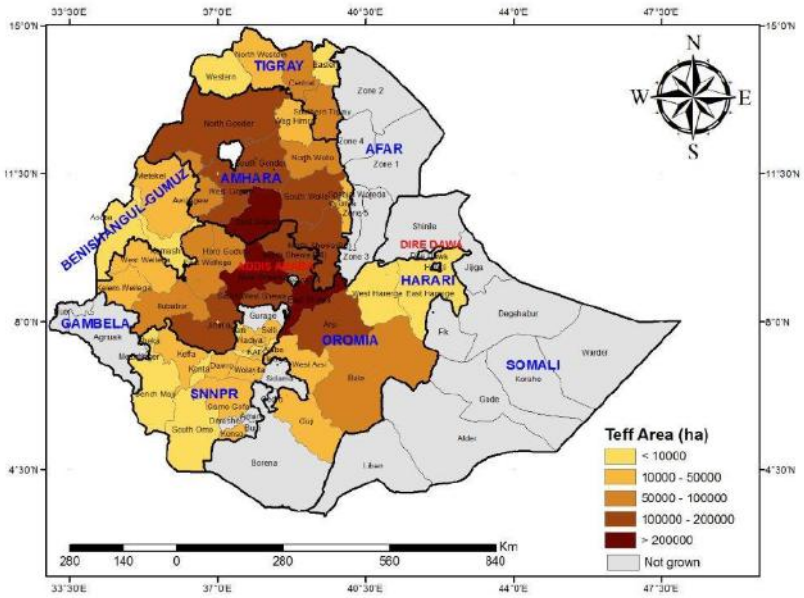
millers or other central markets). Finally, the products reach the consumers either as whole or milled grain (Alastair Orr, 2017).




Source: Alastair Orr, 2017

***Figure 3-6: Teff value chain in Ethiopia***

Regional focus areas: The major teff producing areas are Amhara, Central Oromia and West Tigray. Together, these two regions account for 85.5% of the teff area and 87.8% of the teff production. White teff is the preferred variety, but it grows only in the highlands of Ethiopia. It requires the most rigorous growing conditions, has the mildest flavor, and is the most expensive type of teff.




Source: Yumba et al. (2014)

***Figure 3-7 Ethiopia - Teff production by region***

### 3.1.4 Post-Harvest Food Loss Analysis – Wheat and Teff

In Ethiopia, teff and wheat are subject to considerable food losses during post-harvest activities.
For teff, the drying and harvesting stage sees a 3.50% loss, and the same percentage is lost during shelling and threshing. Winnowing contributes to a 2.50% loss, while household storage results in a minimal 0.30% loss. Transportation from the field incurs a 2.50% loss, and the transport to market adds a 1% loss.

Similar loss patterns are observed for wheat, with drying and harvesting accounting for a 4.40% loss, shelling and threshing causing a 3.50% loss, and household storage leading to a higher loss of 4.80%. Transportation from the field causes a 2.50% loss, and transport to market adds another 1% loss. These figures are also sourced from the APHILIS database.

## 3.2 E&S POLICY FRAMEWORK

### 3.2.1 Agricultural National Strategies:

Climate Resilient Green Economy National Adaptation Plan (NAP-ETH): It is a 15-years nationwide cross-sectoral document aiming at strengthening holistic integration of climate change adaptation in Ethiopia's long-term development pathway. The plan aims at reducing vulnerability to the impacts of climate change, by building adaptive capacity and resilience to enhance economic development; and facilitating the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programs and activities. The plan builds on ongoing efforts to address climate change in the country's development policy framework, including the Climate Resilient Green Economy (CRGE) strategy and the second Growth and Transformation Plan (GTP II) (2016 – 2020), as well as sectoral climate resilience strategies and regional and municipal adaptation plans. The goal of the plan is to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience. The Plan focuses on a number of sectors identified as most vulnerable, namely agriculture, forestry, health, transport, power, industry, water and urban.

Climate Resilient Green Economy (CRGE) strategy: Launched in 2011 to foster a climate-resilient and middle-income green economy by 2025. It demonstrates Ethiopia's commitment to bypassing a conventional economic development approach by creating a green economy where economic development goals are met in a sustainable way. The CRGE strategy is targeted to achieve green or low emissions economic growth that is resilient in the context of the adverse effects of climate change. The CRGE Strategy is fairly unique in terms of its integration of economic and climate change goals. The CRGE Strategy consists of a Climate Resilience (CR) component and a Green Economy (GE) component, and adaptation and mitigation programmes are prioritized within the Strategy, with the CR component focusing on climate change adaptation. The strategy identifies four pillars of development in the green economic action plan: Improve crop and livestock production practices for higher food security and farmer income while reducing emissions; protect and reestablish forests for their economic and ecosystem services, including as carbon stocks; expand electricity generation from renewable energy sources for domestic and regional markets; leapfrog to modern and energy-efficient technologies in transport, industrial sectors, and buildings. The priority CRGE sectors are: agriculture, forestry, energy, water, transport, industry and urban/housing.

Postharvest Management Strategy in Ethiopia – 2024 – 2030: The vision of the Strategy is to assist Ethiopia in achieving under five percent Post Harvesting Loses (PHL)in 2050. The overall goal of the strategy is to halve the PHL of agricultural food commodities by 2030 and contribute to Ethiopia's food and nutrition security and economy. The mission of the strategy is to improve PHM of agricultural food commodities, thereby reducing PHL and food safety risks by providing policy focus, raising awareness, encouraging agro-processing and value addition, upgrading infrastructure, facilitating financing and investment, and strengthening the capabilities and coordination of strategic post-harvest interventions.

Agricultural Extension Strategy of Ethiopia 2017: It is a national sectoral strategy for the period 2017-2030. Overall objective of the strategy is to transform Ethiopia's agriculture through the implementation of pluralistic extension system by providing demand-driven and market-oriented extension services to male, female and youth farmers, pastoralists and agro pastoralists. This strategy was developed on the belief that an effective and efficient agricultural extension system plays a vital role in enhancing the agricultural productivity and production of smallholders through the development of innovative, systematic, and dynamic agriculture extension services. Its main objective is to transform Ethiopia's agriculture, from the subsistence agricultural production to a commercialization, through the implementation of a pluralistic extension system. The strategy integrates best practices and innovation for effective delivery of extension services to smallholder farmers.

The Strategy aims to contribute significantly to the attainment of food and nutrition security, poverty reduction and wealth creation in the country through the adoption and the adaptation of improved technologies, good practices and methods.

**Ethiopia's updated Nationally Determined Contributions (NDC):** Ethiopia's updated Nationally Determined Contributions (NDC) emphasize a robust approach to fortifying its agricultural sector against climate change impacts. Key strategies include promoting climate-smart agriculture by enhancing productivity and adopting resilient crop varieties. The NDC also stresses sustainable land management practices such as reforestation and reducing pre-harvest losses to improve land health and productivity. Water resource management is critical, with plans to expand irrigation systems and improve water conservation through integrated watershed development. In livestock management, Ethiopia aims to enhance efficiency and productivity while reducing methane emissions through better feeding practices. Adaptation measures include improving rangeland management, strengthening crop and pest monitoring, and developing drought and crop insurance mechanisms to protect farmers from climate-related economic impacts. Institutional support and policy integration ensure these actions align with national development plans and involve extensive stakeholder engagement.

**Ethiopia's Long-Term Low Emissions and Climate Resilient Development Strategy (LT-LEDS) (2020-2050):** As part of the Paris Agreement, Ethiopia prepared this strategy to serve as a roadmap for long term decarbonization and climate resilience, which is particularly useful in the context of Nationally Determined Contributions (NDCs). It provides a structure for establishing milestones in Ethiopia's NDC including using the trajectories to benchmark for revised and updated NDCs. The LT-LEDS outlines the priorities for attracting international and private-sector financing for green, low carbon, and climate-resilient projects over the near and long term. The LT-LEDS has identified the (Business-As-Usual) BAU scenario and three Net Zero Emissions (NZE) scenarios. LT-LEDS serve as a critical role in implementing the common objectives under the United Nations Framework Convention on Climate Change (UNFCCC) guidelines and the Paris Agreement. Following a wholistic long-term planning approach, the LT-LEDS could be a key tool in bridging Ethiopia's sustainable development and climate mitigation and adaptation objectives.

**Seed System Development Strategy:** It is a national strategy to transform the seed system. The seed system refers to the full set of activities and stakeholders involved in effectively developing, producing, and distributing seed to smallholder farmers. Its vision is to create an innovative market-led multi-sector seed system that effectively contributes to improvement of farmers' livelihood. The strategy intends to guide domestic and international partners in targeting their investments and efforts towards addressing systemic challenges. The strategy identifies that challenges in the seed system are diverse and complex across the value chain and at all levels of governance. This national seed sector strategy was developed in a strategic, systematic, and stakeholder-consultative process, with input from an inclusive set of stakeholders.

**Environmental Policy of Ethiopia:** The overall goal of the Environmental Policy is to improve and enhance the health and quality of life of all Ethiopians and to promote sustainable social and economic development. This can be achieved through sound management and use of natural, human-made and cultural resources and the environment as a whole so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. The policy was designed to provide guidance on sustainable development, use and management of the natural resources and the environment. The Federal Democratic Republic of Ethiopia (FDRE) Constitution recognizes environmental sustainability as a key prerequisite for lasting success. The key guiding principles of the policy include every person has the right to live in a healthy environment; sustainable development, use and management of renewable resources; minimized use of non-renewable resources minimized; appropriate technologies using renewable and non-renewable resources; Environmental protection is necessary; Environmental/social costs resulting in pollution shall be incorporated into public and private sector

planning; Market failures shall be corrected through the assessment of user taxes; Support community resource users to sustainably manage their own environment; Women shall be treated equally with men and empowered to be totally involved in any activity; Existence of a system ensuring conditions for sustainable natural resource management; Social equity shall be assured; Accurate assessment and monitoring of environmental conditions shall be undertaken; Increased awareness of environmental promoted by policy makers; Local, regional and international environmental interdependence shall be recognized; Natural resource and environmental management activities shall be integrated; The integrated implementation of cross-sectoral policies and strategies shall be seen as a prerequisite to achieving the objectives.

Water Resource Management Policy: The overall goal of the Policy is to enhance and promote all national efforts towards the efficient, equitable and optimum utilization of the available Water Resources of Ethiopia for significant socioeconomic development on sustainable basis. Fundamental principles of the Policy that guide the equitable, sustainable and efficient development, utilization, conservation and protection of water resources in Ethiopia include: water is a natural endowment commonly owned by all the peoples of Ethiopia; access by every Ethiopian to sufficient water of acceptable quality, to satisfy basic human need; water resources development shall be underpinned on rural-centered, decentralized management, participatory approach as well as integrated framework; promotion of the participation of all stakeholders, user communities; particularly women's participation in the relevant aspects of water resources management.

Postharvest Management Strategy of Grains in Ethiopia: The strategy outlines objectives and measures to guide, promote and support actions at all levels in the agricultural value chain to significantly reduce postharvest losses in grains. This strategy aims at contributing to improved food security and poverty reduction by attaining food self-sufficiency in basic food commodities and improved incomes of the Ethiopian people. The proposed intervention areas include: the evaluation of effectiveness of postharvest management systems, use of adaptive research and development to postharvest management systems, provision of production, harvesting and storage postharvest technologies, development of appropriate skills, training and human development and care for environmental factors.

### 3.2.2 Key Legislation

The Federal Democratic Republic of Ethiopia (FDRE) Constitution – Proclamation No 1/1995: The constitution was adopted on 1st December 1994 and issued on 21st August 1995. Being the country's supreme law, the constitution establishes a framework for the overall governance and structure. The Constitution stipulates basic and comprehensive principles and guidelines for environmental protection and management in the country. The concept of sustainable development and environmental rights are presented in Articles 43, 44 and 92 of the Constitution. In this regard, Article 43 (Right to Development) prescribes that the Peoples of Ethiopia as a whole, and each Nation, Nationality and People in Ethiopia in particular have the right to improved living standards and to sustainable development and participation in national development and, in particular, to be consulted with respect to policies and projects affecting their community. Under Article 44 (Environmental Rights), the constitution recognizes the right of citizens to live in a clean environment, and, where they are displaced or their livelihood has been adversely affected by the development projects undertaken by the government, the rights to get commensurate monetary or alternative compensation, including relocation with adequate state assistance. Article 92 of the Constitution recognizes the government's role in ensuring that all Ethiopians live in a clean and healthy environment. It also stipulates that the design and implementation of development programs and projects in the country should not damage or destroy the environment; and recognizes the right of the people to be consulted and express their views on the planning and implementation of environmental policies and projects that affect them.

Seed Proclamation No. 1288/2023: The Ethiopian government adopted a seed law, 'Seed Proclamation 1288/2023', repealing the previous Seed Proclamation 782/2013. The Seed Proclamation is a seed legislation in Ethiopia and is implemented by the Ministry of Agriculture. This plan is applicable to any seed. Without prejudice to this provision the Proclamation shall not be applicable to a) the use, by any person, of farm-saved seed; b) the exchange of farm-saved seed among smallholder farmers or pastoralists or any seed sale conducted among themselves on a non-registered for variety protection right; c) seed intended for research and education purpose.

Forest Development, Conservation and Utilization Proclamation No. 1065/2018: Proclamation No. 1065/2018 in Ethiopia focuses on the development, conservation, and sustainable utilization of forest resources. It concerns both private and public forests and includes measures for promoting forest development, such as granting rural land to private individuals and organizations and developing state production forests on a concession basis. Powers and duties of forestry management and conservation with regards to the Ministry of Environment, Forest and Climate Change, any regional governmental executive organ have been defined in the Proclamation.

Plant Breeder's Right Proclamation No. 1068/2017: The proclamation has provisions to all genera and species of plants throughout the country, except those genera and species of plants excluded by the directives of the Ministry of Agriculture and Natural Resources. It sets out aspects of protection of Plant Breeder's Rights (PBR). The proclamation has prescribed the criteria for protection of plant variety, the scope and exemptions of PBR, farmers' and pastoral communities' right, compulsory licensing, etc. The Proclamation considers rights for farmers' or pastoral communities: 1) smallholder farmers or pastoral communities shall have the right to save, use, exchange and sell farm-saved seed of any variety on the non-commercial marketing; 2) any farmer or pastoral community shall have the right to save and use farm-saved seed of any variety of food crops and other species that directly supporting his livelihoods.

Irrigation Water Users' Associations Proclamation No. 841/2014: This Proclamation regulates irrigation water user' associations, which are formed on irrigation infrastructures constructed by federal government throughout Ethiopia. The proclamation also sets out the guiding principes, formation and registration of the association, defines rights and duties of members, outlines the supervising bodies with their powers and responsibilities provides for the dissolution of association and liquidation of association, and allows a federation of irrigation water users' association to be formed.

Pesticide Registration and Control Proclamation No. 674/2010: This Proclamation prescribes the registration, manufacture, handling, packaging and labelling, use and placing on the market of pesticides. It also concerns pesticides subject to the Prior Informed Consent Procedure under the Rotterdam Convention. The Proclamation establishes a Pesticides Advisory Board to oversee pesticide aspects in Ethiopia. According to the proclamation, no pesticide shall be registered unless the efficacy, safety, and quality is tested under field or laboratory conditions and approved by the Ministry of Agriculture (MoA).

Ethiopian Water Resources Management Proclamation (No. 197/2000): It is currently the basic legal instrument governing the management, planning, utilisation and protection of water resources in Ethiopia. The purpose of this Proclamation is to ensure that all surface and ground waters of Ethiopia are properly protected and managed. Article 5 recognizes that all water resources of the country are the common property of the people and state. The integrated Basin Master Plan Studies and Water Resources legislative framework that serves as a point of reference and ensure that any water resource is put to the highest social and economic benefit of the people of Ethiopia. The social and economic development programmes, investment plans and programmes and water resources development activity of any person, shall be based on the country's Water Resources Policy, the relevant Basin Master Plan Studies and Water Resources laws. The Supervising body shall ensure

and administer that the management of any water resource is put to the highest social and economic benefits of the Ethiopian people in accordance with the provisions of the Ethiopian Water 'Resources Policy, Basin Master Plan Studies arid and Water Resources laws. Management of the water resources of Ethiopia shall be in accordance with a permit system.

Agriculture Resources Development and Protection Proclamation (No. 660/2009): Ethiopian Organic Agriculture System Proclamation No. 488/2006: the proclamation is applicable to the production, processing, packaging, labelling, storing, transportation marketing, exportation and importation of agricultural products which carry or are intended to carry labels referring to organic production methods. This proclamation outlines the procedures of organic production at farm level, pest management, permitted biological control, transportation, storage, processing, labelling, advertising and minimum inspection requirements as well as inspection and precautionary measures and accreditation requirements for inspection and certification bodies.

Access to Genetic Resources and Community Knowledge, and Community Rights Proclamation (No. 482/2006): This proclamation applies to access to genetic resources found in situ or ex situ conditions and community knowledge with exceptions to customary use and exchange of genetic resources and the sale of produce of biological resources for direct consumption. It includes the protection and enhancement of customary use of genetic resources by Ethiopian communities which are relevant to the conservation and sustainable use of the biodiversity resources of the country. The Proclamation defines ownership rights of genetic resources and community knowledge and provides for protection of community rights, access to genetic resources and sharing of benefits. Access to genetic resources by outsiders requires a permit to be granted by the Institute of Biological Conservation. The Proclamation also regulates the exploration of genetic resources and provides for administration in relation with the implementation of its provisions.

Fertilizer Manufacturing and Trade Proclamation (No. 137/1998): It applies to a person who is engaged in the business of fertilizer. It provides regulations to address fertilizer production, distribution, trade, importation, exportation, manufacturing, packaging, labelling and sale. The proclamation is divided into 5 Sections: General (1); Competence Assurance Certificate (2); Manufacturing, dealing and distribution of fertilizer (3); Enforcement of bodies and their duties (4); Miscellaneous (5). Article 13 of the proclamation stipulates that all fertilizers traded in Ethiopia shall be conform the requirements of Ethiopian standards and shall be registered by the Agency for use in Ethiopia as fertilizer.

Ethiopia's Updated Nationally Determined Contributions (NDC): It is an enhancement of the first NDC for the period of 2020 – 2030. As a signatory to the Paris Agreement, Ethiopia formulated an NDC in 2015 which was updated in 2021. Ethiopia pledged to limit its annual net emissions to 126 Mt CO2e or lower by 2030, which would constitute a 278 Mt CO2 e (or 69%) reduction from the BAU scenario of 403 Mt CO2e. This is a commitment to achieve 20% of this scenario out of its own financial resources (unconditional scenario), whereas it requests international financial support to achieve the other 80% (conditional scenario). With over two decades of string growth in carbon emissions, Ethiopia's emissions have nearly doubled from 160 Mt CO2e to 300 Mt CO2e in 2020 as shown in the figure below.

Rural Land Administration and Land Use Proclamation No. 456/2005: The proclamation sets forth a system for rural land management and use and for sustainable rural land use planning based on the different agro-ecological zones of the country necessary for the conservation and development of natural resources.
The proclamation provides rules relative to acquisition and use of rural land by peasant farmers or pastoralists, transfer of rural land use rights, distribution of rural land, obligations for land holder such as allowing construction of irrigation canals, resolution of disputes, and restrictions on the use of rural land. The proclamation prescribes under Part three, article 13:

Land use planning and proper use of sloppy, gully and wetlands the development of a land use master plan taking into consideration soil type, land form, weather condition, plant cover, socio-economic conditions, an equitable water use system between upper and lower watershed communities and on the lands where soil and water conservation works have been undertaken a system of free grazing shall be prohibited and a system of cut and carry feeding shall be introduced step by step.

Agricultural Production Contract Proclamation No. 1289/2023**:** The proclamation guides the particular nature of agricultural produce including agreements related to processed feed, seed, brees, plants (cereals, pulses, oil crops, vegetables, fruits, root crops, spices, forage, non-banned stimulants, industrial crops, forest and forest products and other cultivated crops), animal (cattle, sheep, goat, draft animals, camel, chicken, bee, silkworm, pig, and any others that can be domesticated in the future) and fish and their products in a raw or produced and processed form between a producer and a contractor with a comprehensive legal framework. The Proclamation defines an agricultural production contract as an agreement between a contractor and a producer with regards to the supply of Agricultural Produce.

### 3.2.3 Regulatory Bodies

The Ministry of Agriculture (MoA)**:** The MoA oversee agricultural and rural development policies at the federal level. MoA aims to promote structural transition, make agricultural productive and competitive, increase farmers' and pastrolists' income lifting them out of poverty. It is also a federal government body that drives the development of laws, standards and procedures related to the seed system. The MoA is also responsible for international trade and exchange of germplasm and seeds, as well as the entry of international organizations involved in seed production and supply. At the Regional level, Bureaus of Agriculture (BoAs) enforce these laws and standards. BoAs have regional seed quality control labs, which undertake inspection, sample collection and testing. The main roles of MoA include promoting market oriented modern agricultural system, conserving, developing and sustainable use of natural resources, develop modern agricultural system and building capacity for disaster prevention and preparedness.

The main directorates supporting the MoA are: Agricultural Development Directorate, Livestock Development Directorate, Natural Resources Directorate and food Security Directorate, agricultural INPUTS and Commodity Marketing Directorate, Operations Service Directorate, Agricultural Extension and Capacity Building Directorate, Horticulture Directorate and Policy, Program and Communication Excellence Directorate.

Animal and Plant Health Regulatory Directorate (APHRD)**:** The directorate under the Ministry of Agriculture has the mandate to regulate, monitor and control SPS standards for plants, animals and their derivatives at the federal level. The directorate has two separate divisions to handle animals and plants: Epidemiology and Disease Control; and Quarantine, Inspection and Public Health.

Ethiopian Agricultural Transformation Agency (ATA)**:** ATA is a strategy and delivery-oriented government agency created to assist in accelerating the growth and transformation of the county's agriculture sector. The agency is mandated to support and enhance the impact of the Agricultural Transformation Agenda, Agricultural Commercialization Clusters (ACC) Initiative, and the Livestock and Fisheries Sector Development Project (LFSDP) and catalyse transformation of the agriculture sector.

Ethiopian Biodiversity Institute (EBI)**:** It is the main national entity in charge of conserving the country's biodiversity, the conservation of biological resources and ensuring equitable sharing of benefits arising from the use of genetic resources. EBI was established in May 1976 as a Plant Genetic Resources Center, Ethiopia (PGRC/E) through a bilateral technical

cooperation agreement between the Governments of Ethiopia and Germany. It was the re-established in 1998 as the Institute of Biodiversity Conservation and Research (EBIR) broadening its mandate and duties to implement Ethiopia's obligation to the Convention of Biological Diversity (CBD). In 2004, it was amended to Institute of Biodiversity Conservation (IBC). The Institute was restructured and renamed to Ethiopian Biodiversity Institute (EBI) in 2023. The EBI has a mandate of conservation and sustainable utilization of all forms of biological resources including plants, animals and microbial genetic resources as well as associated indigenous knowledge.

EBI has the responsibility to implement international convention, agreements and obligations to which Ethiopia is a signatory. It consists of eight key directorates, including: Crop and Horticulture Biodiversity Directorate; Animal Biodiversity Directorate; Microbial Biodiversity directorate; Forest and Range Land Plants Biodiversity directorate; Genetic Resources Access and Benefit Sharing Directorate; Research, Dissemination & Project Implementation Directorate; Branch, Centers and Stakeholders Directorate and Ecosystem Directorate.

National Biodiversity Platform (NBP-Ethiopia): the platform is aimed at strengthening the science-policy-action interface through enhanced engagement of the policy/decision makers, the scientific community and actors with respect to conservation of Ethiopia's biological resources, maintenance of ecosystem services and equitable sharing of benefits arising from the use of genetic resources. It is a platform that connects diverse stakeholders including policy makers, scientists, civil society, private sector and local communities.

Ethiopian Institute of Agricultural Research (EIAR): Established in 1966 by Proclamation, it is one of the oldest and largest agricultural research institutes in Africa. EIAR comprise of 69 research Centers and sites located across various agro-ecological zones. EIAR's mission is to conduct research that will provide market competitive agricultural technologies that will contribute to increased agricultural productivity and nutrition quality, sustainable food security, economic development, and conservation of the integrity of natural resources and the environment. The organization has the following mandates:

- Generation and adaptation of improved agricultural technologies;
- Demonstration and popularization of improved technologies; and
- Multiplication and provision of source technologies.

The institute is supported by the following directorates, including:

1. Deputy Director General (DDG) of Research coordinates and manages the research directorates that develop technology/knowledge, organized under the institute and performs as the director general. The has been further subdivided into eight directorates, namely: Crop Science Research Directorate; Animal Science Research Directorate; Natural Resource Management Research Directorate; Agricultural Economics Research Directorate; Plant Protection Research Directorate; Food Science and Nutrition Research Directorate; Agricultural Biotechnology Research Directorate; and Agricultural Engineering Research Directorate.
2. DDG for Technology Commercialization: The main objective of this directorate is to facilitate the institute's technologies and knowledge to generate income through a market-oriented approach. DDG for Technology Commercialization is in charge of five directorate including: Agricultural Extension and Communication Research Directorate; Technology Multiplication and Seed Research Directorate: Pastoral, Agro-Pastoral and Special Support Regions Research and Capacity Building: Intellectual Property and Knowledge Management Directorate: and Climate Change, Geospatial and Biometrics Research Directorate.
3. Research System Coordination Office (RSCO) aims to build an effective national agricultural research system that can provide reliable technologies at any moment by projecting the demands of agricultural development as well as

future global market trends. In order to fulfil its roles and responsibilities, the RSCO has three directorate organized under it as follows: Institutional Strategic Partnerships Directorate (ISPD); Research Capacity Building Enhancement Directorate (RCBED); and Research Centers Coordination Directorate (RCCD).

Regional Agricultural Research Institutions (RARIs): They are institutions which conduct research that addresses the specific needs of a particular region. At the regional level, they promote multidisciplinary research and participate in collaborative national research programs in any one or more of the crops, livestock and natural resources commodity programs.

Organic Agricultural Production System Council: Ethiopian Organic Agriculture System Proclamation No. 488/2006 establishes the Organic Agricultural Production System Council that helps the Ministry of Agriculture in accreditation and supervision of organic certifications.

Pesticides Advisory Board: It is a statutory body established under the Pesticide Registration and Control Proclamation No.674/2010 overseeing pesticide-related matters.

Ethiopian Agricultural Research Council Secretariat (EARCS): It is a government funded office coordinating national agricultural research system. It has eight research coordination units of which the Agricultural and Biomass Engineering. It is a statutory body established by the Ethiopian-Agricultural-Research-Council-and-Secretariat-Establishment-Council-of-Ministers-Regulation-No.383/2016. The objective of the council is to coordinate, lead and set directions and build capacity of the national agricultural system. The council has been assigned the following powers and duties, amongst others:

- Advising the government on matters related to agricultural research policy;
- Coordinate and lead agricultural research institutions to enable them to fulfil their responsibilities of delivering agricultural technologies in collaboration and partnership;
- Align agricultural research programs with the national development plan and strategy and set priorities accordingly; and
- Support national agricultural research institutions to build their skilled manpower and state of the art research infrastructure based on the technology needs of the country.

Regional Agriculture and Natural Resources Bureau: These are bureaus found in each Ethiopian region. They collaborate with MoA to promote sustainable agriculture and resource management. Examples include Tigray Bureau of Agriculture and Natural Resources, Oromia National Regional State, Bureau of Agriculture and Natural Resource

National agricultural research system (NARS): includes the Ethiopian Institute of Agricultural Research (EIAR), Regional Agricultural Research Institutes (RARIs) and Higher Learning Institutes (HLI). The mandates of EIAR and RARIs includes follow up the implementation of agricultural research policy, initiate new and improved policy proposals and submit the same to the government and when approved, implement and follow up the implemented thereof and undertake, or cause, the undertaking of agricultural research activities on the bases of the agricultural research policy and strategy.

### 3.2.4 Emerging Regulation

Draft Rural Land Administration and Land Use Proclamation No. 1324/2016 (2024)6: this revised legislation will broaden land utilization privileges and farmers are authorized to leverage tenure certificates as security for financial loans. It is designed to promote effective governance in administration and management of rural lands. The legislation sets forth a legal structure mandating regions with pastoralist communities to implement designated pastoralist land statutes. It includes provisions for the surveying and registration of rural lands to establish formal tenure and delineate boundaries. The draft proclamation emphasizes an inclusive system that supports women, youth, handicapped and communities for sustainable development.

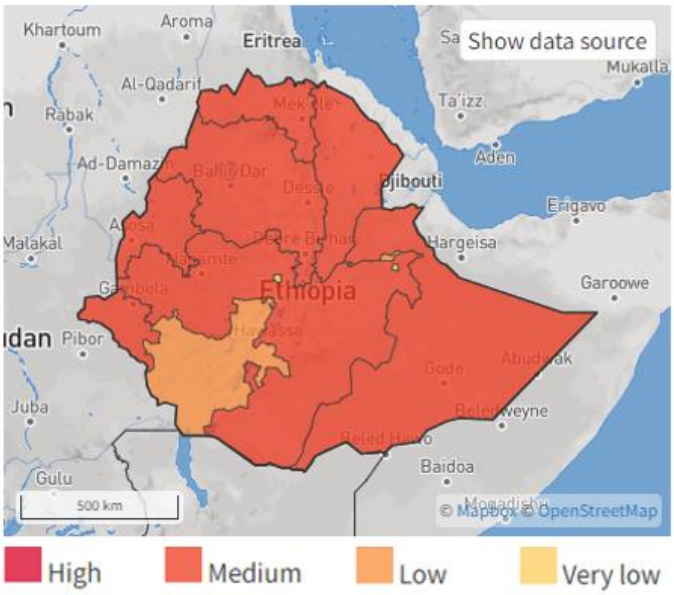
[6] Refer to: Ethiopia: Revised Land Bill Provides Financial Access to Smallholder Farmers Through Tenure Certificates - allAfrica.com

## 3.3 ENVIRONMENTAL RISKS ANALYSIS

### 3.3.1 Water availability

Ethiopia has 12 river basins with an annual discharge of 122 billion cubic meters and an estimated groundwater potential of 2.6 to 6.5 billion cubic meters, resulting in a relatively large amount of physically available water, averaging 1,575 cubic meters per person per year. However, a lack of water storage infrastructure and high spatial and temporal variability in precipitation mean that most farmers do not have enough water to produce multiple crops per year (Seleshi Bekele Awulachew, 2007).

According to currently available data on ThinkHazard!, Ethiopia is dealing with water scarcity. The water level is rated as "medium", which means there is up to a 20% chance of drought occurring in the next 10 years. Based on this information, the impact of drought needs to be considered at all stages of the project, especially its impact on staff and stakeholders, and in the design of buildings and infrastructure. Project planning decisions, project design methods need to take the risk of drought in all phases of the agricultural value chain into account (see figure below).




Source: ThinkHazard!

*Figure 3-8: Ethiopia - Water Scarcity level*

Drought in Ethiopia has had a major impact on agricultural crops. Sorghum, wheat, and rice are among the main crops affected by drought in Ethiopia (Ashenafi Yimam Kassaye, 2021). On the other hand, teff has an excellent resistance to drought, as well as to water logging stresses, which makes it the most favoured staple food in the country by farmers (Gebrehawariyat, F.M., W. Haile, T. Mamo, I. Zipori, and E. Sokolowski, 2018). The southern and eastern parts of the country have been particularly hard hit, as there have been five consecutive rainy seasons without precipitation. Erratic and scarce rains have caused crop losses for farmers and exacerbated the situation for farmers who were still recovering from the 2016-2017 drought. Entire communities are facing food shortages, and pasture and water supplies are also drying up. As of Northern Ethiopia, the region faces water stress due to its geographic and climatic conditions; but not just, groundwater resources are not well understood, and natural contamination from fluoride is present throughout the Great Rift Valley (Afar-Denakil, Awash, Omo-Gibe, and Rift Valley Basins) (USAID, 2021). Water supply is concentrated in the Abay Basin (western Ethiopia), the most important river basin in Ethiopia, covering an area of 199,812 square kilometres. Not only by rainfall (1000mm to 1500mm annually) but also contribute to over 62% of the flow of the Nile River.

Humanitarian challenges caused by the drought include 24 million people living in affected areas as of the end of 2021, an estimated 11 million experiencing food insecurity, and around 6.85 million livestock deaths (OCHA, 2023). Furthermore, deforestation, population growth and soil erosion are contributing to recurrent droughts in Ethiopia, which are impacting agriculture through crop losses, reduced yields and increased livestock mortality (Amsalu, 2019).

This high reliance on water resources means that Ethiopia is very vulnerable to water-related climate shocks – like water scarcity, drought and floods. For example, a modest 5% decrease in rainfall could cause a 10% decrease in agricultural productivity and reduce the GDP derived from the Awash River basin by 5%. The Awash River basin is already vulnerable. It often experiences both floods and droughts. Besides, access to water is very geographically uneven, with rainfall and surface water being scarce downstream and relatively abundant in the highlands (University of Oxford , 2024).

### 3.3.2 Land Degradation and Soil Erosion

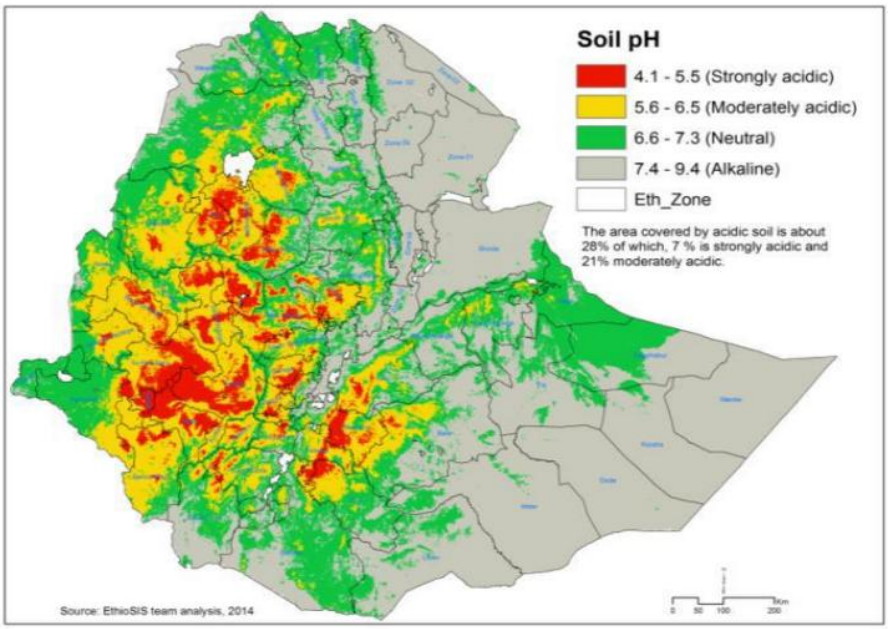
In Ethiopia, over 85% of the country's land is deteriorated, making land degradation a significant problem. The loss of ecosystem services is only represented by roughly 51% of land degradation. The remaining 49% is the loss of ecosystem services that are cultural, regulatory, and supportive. The most common cause of soil erosion in Ethiopia is water-induced soil erosion. As 80% of the population is employed in rain-fed agriculture, which is the cornerstone of Ethiopia's economy.
Due to the decline in fertility of agricultural soils, soil erosion adversely affects Ethiopia's economy and agricultural production. It has now become a significant problem affecting all aspects of the social, political and economic life of Ethiopians. It has become one of the main impediments to agricultural growth and food security in the country. The main causes of soil erosion in the Ethiopian highlands are rapid population growth, significant soil erosion, deforestation, overgrazing, inadequate vegetation cover, uneven crop yields on steep slopes, erosive rainfall patterns, lack of fallow land and inadequate conservation measures. The impacts of soil erosion include loss of fertile soil resulting in less land available for agriculture. Family food security is negatively affected by soil erosion which directly worsens rural livelihoods and has a devastating impact on socio-cultural and ecological conditions in Ethiopia. Reduced crop yields are a direct consequence of soil erosion resulting in higher rates of poverty among farm families (Tadesse & Hailu, 2024).

Due to severe climatic circumstances, including global climate change and the ensuing changes in land-use patterns brought about by agricultural intensification, land degradation processes have increased, and resulting in yield losses in many areas of both semi-arid and arid Ethiopia (Zewdu, Suryabhagavan, & Balakrishnan, 2014). Based on satellite imagery, recent estimates reveal that hotspots for land degradation over the past three decades have covered over 23% of the nation's geographical area, primarily in sizable portions of Gonder, Wollo, and Tigray, among other regions (Tesfa & Mekuriaw, 2014).

### 3.3.3 Soil Fertility and Acidification

More than 50 years ago, it was found that the most deficient nutrients in most agricultural soils in Ethiopia were nitrogen (N) and phosphorus (P). As a result, fertilizers containing N and P (urea and DAP) began to be applied in the late 1960s, dramatically increasing the yield of several crops. Consequently, the use of urea and DAP has become the most widely used fertilizers by farmers. And according to the same findings, potassium application significantly increased N, P, and K concentrations in grains and straw, indicating that K was a principal limiting factor in teff crop development. Consequently, the uptake rates of these nutrients rose significantly, which indicates a possible need to increase their application rates when K is adequately supplied. (Gebrehawariyat, F.M., W. Haile, T. Mamo, I. Zipori, and E. Sokolowski, 2018)

This long-term unbalanced fertilization practice has led to deficiencies in other nutrients, especially potassium (K), Sulphur (S), zinc (Zn), and boron (B), beginning to appear. Combined with widespread depletion of organic matter, (ATA, 2015), increasing soil acidification and degradation of physical soil properties such as compaction and clay formation, nutrient and organic matter depletion poses a major threat to agricultural productivity, rural livelihoods and the sustainability of agro ecosystems, the study found. Loss of nitrogen and phosphorus due to soil erosion by water causes huge economic losses to farmers (Erkossa, Laekemariam, & Abera, 2022).




Source: ATA, 2015

***Figure 3-9: Ethiopia - Soil PH***

Soil acidity is increasingly challenging crop productivity in the high rainfall areas of Ethiopia. About 43% of cultivated land in humid and sub-humid highlands of the country is affected by soil acidity, of which about 28% are strongly acidic. Soil acidity limits the availability of essential nutrients such as P, K, calcium, and magnesium and affects the activities of essential soil organisms (Erkossa, Laekemariam, & Abera, 2022). The total area of Ethiopia is 111.8 million hectares out of these only 79 million of hectare is suitable for cultivation. Of this soil, about 27.7% have moderate to weak acid soils (pH in KCl of 4.5 -5.5), and around 13.2 % are strong acid soils (pH in KCl of <4.5 and nearly one-third have aluminium toxicity problem (Negese, 2021).

Restoring soil pH to optimal ranges for agriculture can have a significant impact on yields, especially for acid-intolerant crops like wheat and barley. The application of agricultural lime is the standard corrective measure, but challenges such as large application requirements, lack of farmer awareness, and weak lime supply chains make addressing this complex (James M. Warner, 2023).

### 3.3.4 Pesticides use

Ethiopia is the second most populous nation in Africa with around 80% of the population still depending on agriculture which intensively uses pesticides (Beyene Negatu, 2021). Pest control methods regardless of their intrinsic hazard, are used in the agricultural sector of Ethiopia. Compared to other developing countries, the use of pesticides in Ethiopian agriculture is low and is mostly present in large-scale farming, especially in cotton and sesame production and some in horticultural crops.

Most small-scale farmers are not using pesticides. However, some farmers use herbicides like 2, 4- D for weed control in cereal crops and pesticides against migratory locusts, armyworms and birds are used during outbreaks (Getahun, 2023).

Although Ethiopia has a number of declarations to minimize and control occupational and environmental risks in general and pesticides in particular (Declaration No. 674/2010 on Registration and Control of Pesticides, Labour Declaration No. 277/2003, and Declaration No. 300/2002 on Control of Environmental Pollution), previous pesticide knowledge, attitudes and practices (KAP) surveys conducted in Ethiopia have shown that farm workers have limited knowledge about the hazards of pesticides, poor awareness about the safe use of pesticides and poor hygiene practices

*Source:* Negatu, Kromhout, Mekonnen, & Vermuelen, 2015

***Figure 3-10: Ethiopia - Disposal of discarded empty pesticide containers collected in one of the large-scale open farms***

### 3.3.5 Deforestation

As of 2010, Ethiopia had 12.3 million hectares of natural forest, covering 11% of the country's area. By 2023, 36.2 million hectares of natural forest will be lost, equivalent to 20.7 million tonnes of $CO_2$ emissions. From 2001 to 2023, Ethiopia lost 504 kha of tree cover, equivalent to a 4.2% decrease in tree cover since 2000, and 244 Mt of $CO_2e$ emissions according to (Global Forest Watch, n.d.).

*Source:* (sciencephotolibrary , n.d.)

***Figure 3-11: Deforestation in Ethiopia***

Ethiopia has one of the highest rates of deforestation in the world. According to the United Nations, about 1.4 million hectares of forest are lost each year. This destroys the country's biodiversity, soil quality, water resources, and the livelihoods of millions of people who depend on forests for food, fuel, and medicines. The main causes of deforestation in Ethiopia are agricultural expansion, commercial logging, and firewood collection. The government has taken various measures to address the problem, including afforestation programs, community forest management, and the creation of protected areas. However, these efforts have been limited by financial constraints, poor implementation, and weak enforcement. The impacts of deforestation in Ethiopia are severe. Forests regulate water cycles, prevent soil erosion and provide habitat for wildlife. When forests are cut down, land becomes more susceptible to erosion, resulting in loss of fertile soil and reduced agricultural productivity. Deforestation also contributes to climate change by releasing large amounts of carbon dioxide into the atmosphere. Furthermore, deforestation has social impacts, especially on indigenous communities who depend on forests for their traditional livelihoods.

Economically valuable Ethiopian forests, which support the world's only wild population of the Coffea arabica tree, are in decline and will be completely lost in 27 years at current rates of deforestation. Deforestation in Ethiopia is driven by institutional change, land tenure insecurity, resettlement programs, population pressures, agricultural and infrastructure development (ecohubmap, 2024).

### 3.3.6 Genetically Modified Crops

Ethiopia has made strides in adopting favourable legal instruments and introducing some globally endorsed GM crops, including cotton, maize, and Enset (a staple food). However, the country’s biosafety regulations emphasize risk assessment, labelling, and monitoring.

In 2018, the Ethiopian government approved the cultivation of BT- cotton to curb the threat of the cotton bollworm, a moth larva that attacks cotton. The genetically modified Enset (false banana), which is severely affected by bacterial wilt disease, is another crop for which closed laboratory research has been approved **(Tollera, 2024)**. On that note, the same BT (*Bacillus thuringiensis*) gene was also tested on wheat to control insect pests. Which will potentially reduce the need for pesticides during cultivation and improve yields **(JOAN CONROW, 2018)**.

Moreover, The Bill & Melinda Gates Foundation and other groups are funding research into new teff varieties, including genetically modified ones (Caroline Anders, 2024). Recently, a gene-edited semi-dwarf teff was developed, which is 28–42% shorter than the original and has lodging-resistant qualities (Donald Danforth Plant Science Center , 2024).

## 3.4 SOCIAL RISKS ANALYSIS

### 3.4.1 Labour and Working Conditions

Risks associated with Smallholder farming: In Ethiopia, at least three quarters of the total cultivated area is occupied by major cereal crops such as teff wheat, maize and sorghum (Adugnaw & Dagninet , 2020). Smallholder farmers have dominated the agricultural sector in Ethiopia. Smallholder farms are defined by their size mainly smaller than 2 ha and mostly managed with family labour. Smallholder framers cultivate cereals such as teff, maize, wheat, barley and sorghum (Gebeyanesh Zerssa, Debela Feyssa, Dong-Gill Kim, & Bettina Eichler-Löbermann, 2021). The main constraints facing the smallholder farmers include delayed delivery of agricultural inputs, absence of credit markets and lack of access to agricultural technology. In addition, Ethiopia's import of cereals (wheat, rice, barley), edible oil and lint cotton, has continued to rise dramatically every year. The imported cereals are sold at a subsidized prices which dampen local grain prices (Diriba, 2020).

Migrant workers: Seasonal migrant workers move from the highlands to the lowlands of Amhara, Ethiopia, each year during planting, weeding, and harvesting seasons (June–November). The migrant workers are exposed to poor working conditions, and diseases such as malaria.

Occupational Health and safety: Agricultural workers are at higher risk of exposure to different chemicals and pesticides and are more prone to occupational accidents.

Mechanization Adoption: According to (Diriba, 2020), since the neolithic era Ethiopian agriculture is heavily reliant on oxen plow and rain-fed neglecting other technological alternatives. The practice of mechanized agriculture in Ethiopia is estimated at 0.7% for land preparation while it is less than 0.8% for crops thresher machines. This indicates very little use of technology in production. some of the factor contributing to use of technology in agriculture are age, access to credit, socioeconomic, institutional, distance of household's residence to the main road, market Centers and zonal towns (Mesele Belay Zegeye, Abebaw Hailu Fikire, & Getamesay Bekele Meshesha, 2021), shrinking cropland, land tenure issues (refer to section below), and lack pf knowledge and information transfer ( Gebeyanesh , Debela , Dong-Gill , & Bettina , 2021).

### 3.4.2 Child Labour

Ethiopia has a high prevalence of child labour abuse. The Ethiopian government has enacted national legislations to protect children from harmful work. It has also ratified relevant international conventions, instruments and protocols, including:

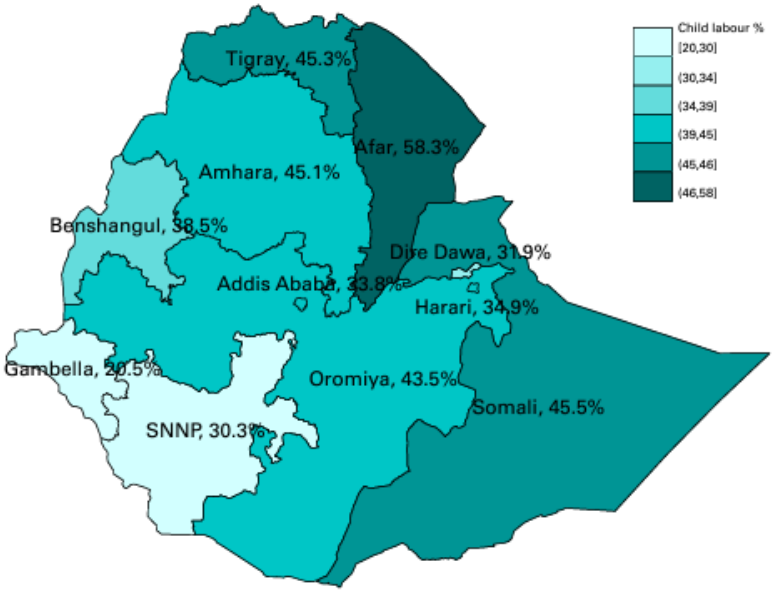
- The United Nations (UN) Convention on the Rights of the Child (CRC, 1989, the most ratified children's convention in the world)
- The ILO Convention 182 on the Worst Forms of Child Labour (1999)
- The ILO Convention 138 on Minimum Age of Employment (1973)

The ILO's Convention No.138 (1973) defines three different minimum age for employment. These are: the basic minimum age for admission into employment, the minimum age applied to hazardous work, and the minimum age applied to light work. Article 2.3 of this Convention sets the minimum employment age at 15 years.

Notable national legislations enacted include the labour proclamation of Ethiopia (No. 1156/2019) which establishes the minimum age of 15 years for employment and forbids the employment of a child under the age of 15 years. Ethiopia's Labour Proclamation No. 377/2003 had initially set the minimum age for work at 14 years and categorized workers of ages 14 to18 as young workers. Children between ages 15 to 17 years old are permitted perform non-hazardous work and with a maximum of seven working days per day.

According to the 2015 National Child Labour Survey (NCLS) report (Ethiopian Central Statistical Agency (CSA) and the International Labour Organization (ILO), 2015), child labour is particularly prevalent in Ethiopia with 42.7% or an equivalent of 15,948,175 children aged 5–17 years engaged in child labour. Agriculture is the most common sector in which children work in Ethiopia. Child labour is more common in rural areas (93%) than in urban areas (39.6%) of Ethiopia. Ethiopian agricultural sector is dominated by smallholder family farms that extorts labour from their children especially among the poor households.

In the figure below, it is noted that child labour highest in Afar (58.3%) and the lowest in Gambella (20.6%). North Shoa and East Gojam are in the Amhara Region where child labour prevalence is at 45.1 %.




Source: UNICEF Ethiopia, CSA and C4ED, 2020

***Figure 3-12: Child Labour prevalence by region***

### 3.4.3 Forced Labour

Human trafficking has become an alarming matter in Ethiopia. The main economic factor that contributes to most Ethiopian being victims of human trafficking is lack of income and poverty. Trafficked girls are exploited in domestic servitude and commercial sex while boys are subjected to forced labour in traditional weaving, construction, agriculture, and street vending. Trafficking is a problem in major cities such as Addis Ababa, Bahir Dar, Hawassa, and Bishoftu[7]. The Ethiopian government has increased anti-trafficking laws enforcement through the Proclamation 1178/2020 to provide for the Prevention and Suppression of Trafficking in Persons and the Smuggling of Persons.

### 3.4.4 Access to Land and Land Tenure

The constitution of the Federal Democratic Republic of Ethiopia explicitly states that the right to ownership of rural and urban land is exclusively vested in the state and peoples of Ethiopia. The government uses lifetime leases or landholding certificates

[7] Refer to: Ethiopia - Migrants & Refugees Section (migrants-refugees.va)

are used as an incentive to get people to help restore degraded land. The current land management system allows farmers to use and manage the land, but they are not the actual owners of the land. Insecure land tenure discourages investment in long-term crops such as trees or establishment of agroforestry systems, especially among tenant farmers. Since farmers do not own the land they work on, this insecurity in land tenure discourages long-term investments in sustainable practices like agroforestry or planting perennial crops, which are essential for improving agricultural productivity and environmental conservation. The uncertainty of land rights particularly affects tenant farmers, who may be less motivated to invest in soil restoration or other long-term improvements **( Gebeyanesh , Debela , Dong-Gill , & Bettina , 2021)**.

There are three main types of land landholding permitted under the Rural Land Administration and Use Proclamation including private, communal, and state holdings. Under the draft Rural Land Administration and Use Proclamation, regulations for acquisition of landholding rights under each specific scenario has been provided. For example, under the existing law, a couple marries, and one partner does not own land, they cannot claim a new holding right whereas in the draft proclamation they will have the right to obtain a new holding right.

### 3.4.5 Land Fragmentation

Arable land is an indispensable resource for Ethiopians to secure food and food self-sufficiency. Cultivated land size is small because it is divided into a number of small-sized parcels, degraded, fragmented and infertile. The size of arable land has been decreasing due to growing population pressure and limited availability of unexploited land.

It is projected that by 2050 the Ethiopia population will be estimated to be 171.8 million by increasing at a rate of 2.5% annually (Alemayhu & Yihunie, 2014). Ethiopia will be ranked third in the rate of population increment globally (UNDESA (United Nations Department of Economic and Social Affairs, 2022). In Ethiopia, the scarcity of arable farmland is very high in the highland areas because of the dominant small-scale farms found here.

### 3.4.6 Community Health and Safety

Hazardous chemical use in Ethiopia presents a significant Community Health and Safety risk. Despite their role in improving agricultural yields, chemicals such as pesticides, insecticides, fungicides and herbicides, improper handling, storage and application has led to widespread health issues among farmers and local communities. Many farmers lack adequate training in the safe use and disposal of hazardous chemicals. Research have shown that occupational use of pesticides can lead to acute and chronic health risks in farmers and the public. Pesticide contamination of water bodies can be hazardous both directly and indirectly to humans and other organism (e.g., soil organisms, fish, bee colonies and wildlife). Improper application of fertilizers can also lead local as well as international consumer risks due to pesticide residues in food items **(Beyene, Sisay, & Yalemtshay, 2021)**.

Community health and safety risks are compounded by issues relating to wetland areas losses and degradation, water logging, salinity in arid and semi-arid areas, acidity in high rainfall areas, and pests (like weeds, diseases, and insects). For instance, waterlogging is highly problematic in Vertisols of the highlands while salinity is in lowland areas of the country. The technological input like synthetic chemical fertilizers has increases the acidity of soil from time to time in high rainfall areas. The mono-cropping system of some crops in the central highland of Ethiopia also led to nutrient depletion. Increased soil

salinity reduces agricultural production and contaminates water supplies. This poses health risks to local communities who rely on these sources for drinking water.

**The Effect of the war on smallholder agriculture in Tigray:** The war in Tigray, Northern Ethiopia, which began in November 2020, has devastated smallholder agriculture and food security. A study found that 81% of households lost crops, 75% lost livestock, and 48% had their farm tools destroyed or looted, with 94% experiencing damage to at least one agricultural component. The conflict, which intensified during the harvest season, led to widespread looting and destruction, affecting over 71% of smallholder farmers and leaving 5.2 million people in need of humanitarian aid **(Manaye, Afewerk, Manjur, & Solomon, 2023)**. The livestock sector, vital to Tigray's economy, saw 76% of livestock looted, slaughtered, or killed, especially in North-western Tigray due to the presence of Eritrean soldiers. Veterinary services were heavily disrupted, contributing to a dramatic decline in livestock numbers: cattle by 74%, sheep and goats by 57%, poultry by 87%, and more. The widespread destruction of farm tools and equipment further cripples future agricultural production. The deliberate targeting of agricultural infrastructure has long-term consequences for food security, creating favourable conditions for pest and disease outbreaks. Immediate action is needed to address these impacts and support recovery efforts in Tigray.

## 3.5 GENERAL E&S RISK CONSIDERATIONS IN FL-RS INTERVENTION IMPLEMENTATION

The introduction of FL-RS in Ethiopia will need to be carefully managed to address the country's specific environmental and social risks.

**Land Degradation:** In Ethiopia, where soil degradation and erosion are critical concerns, the use of biological storage protectants and hermetic storage solutions will be advantageous. These interventions can reduce the need for chemical inputs that contribute to soil degradation. The project interventions should also include training on sustainable land management practices to prevent further degradation.

**Labour Conditions**: The introduction of mechanical threshers and shellers can significantly reduce the physical burden on farmers, especially women and children who are often involved in labour-intensive post-harvest activities. Training programs will be critical in ensuring that these technologies are used effectively and safely, contributing to improved working conditions.

**Child and Forced Labour**: By increasing the efficiency of farming operations, FL-RS interventions can help reduce the reliance on child and forced labour. The project's focus on promoting market connections and farmer organizations can create economic opportunities that diminish the need for child labour. However, continuous monitoring is required to ensure that the benefits of these interventions reach vulnerable populations, particularly in conflict-affected regions, such as the war in Tigray.

**Regional Conflicts:** In Ethiopia, conflicts in regions like Tigray create serious obstacles for FL-RS interventions. These conflicts pose risks to the safety of everyone involved and disrupt the supply and installation of necessary technologies. The instability may also complicate community relation.

# 4 Kenya

## INTRODUCTION

**Kenya's agricultural sector is a cornerstone of the country's economy, contributing approximately 23% of gross domestic product (GDP) directly and another 17% indirectly through its linkages with other sectors.** Crops, particularly maize and beans, are crucial, contributing nearly 70% of the sector's GDP and ensuring food security for over 80% of the population. The agricultural sector also provides employment to about 13 million people, representing about 54% of the total labour force and 70% of the rural population. However, the sector faces challenges such as rapid population growth, climate change and market inefficiencies (United States Agency for International Development, 2023).

**Environmental risks pose a significant threat to the sustainability of Kenya's agricultural sector. Water availability is a major concern, with over 90% of agricultural activities dependent on rainfall, making the sector highly vulnerable to climate change and prolonged droughts.** Smallholder farmers who lack reliable irrigation systems are particularly affected by water scarcity, threatening crop yields and food security (P. Andati, E. Majiwa, M. Ngigi, R. Mbeche, & J. Ateka, 2023). Land degradation, caused by poor soil management, also affects about 30% of Kenya's land mass, leading to significant loss of soil fertility and erosion.

**Social risks also pose significant challenges to the agricultural sector. Child labour remains a critical issue, with around 1.3 million children involved in agricultural work, including maize and bean cultivation.** Despite legislative efforts and international conventions to eliminate child labour, poverty, economic necessity and lack of access to quality education drive the practice. Forced labour affects both adults and children, particularly in tea, coffee and sugarcane cultivation, where economic pressures force families into exploitative labour practices (FAO, 2017). Addressing these environmental and social risks is essential for the sustainable development of Kenya's agricultural sector and the overall well-being of its people.

**To address these challenges, Kenya has put in place several key legal and policy frameworks** (see section 3.2). The Constitution of Kenya 2010, the Labour Act and the Children's Act provide the legal basis for the protection of children's rights and the elimination of child labour. The Crop Act 2013 and the Agriculture Act 2012 promote sustainable agricultural practices and soil conservation. The Environmental Management and Coordination Act (EMCA) strengthens environmental protection measures, while policies such as the Agricultural Policy 2021 and the Agriculture Sector Growth and Transformation Strategy (ASTGS) outline strategic plans for sustainable agricultural development. These legislative measures are essential to mitigate environmental and social risks, promote sustainable growth and ensure the long-term viability of Kenya's agricultural sector.

# LIST OF ACRONYMS

| | |
|---|---|
| AFA | Agriculture and Food Authority |
| AFC | Agricultural Finance Corporation |
| EIA | Environmental Impact Assessments |
| EMCA | Environmental Management and Coordination Act |
| GDP | gross domestic product |
| HHPs | highly hazardous pesticides |
| KALRO | Kenya Agricultural and Livestock Research Organization |
| KEPHIS | Kenya Plant Health Inspectorate Service |
| KSC | Kenya Seed Company Limited |
| LDN | Land Degradation Neutrality |
| NCPB | National Cereals and Produce Board |
| NWHSS | National Rainwater Harvesting and Storage Strategy |
| PCPB | Pests Control Products Board |
| SP | Strategic Plan |
| UN | United Nations |

## 4.1 PILLARS OF KENYA'S AGRICULTURAL SECTOR: FOCUS ON MAIZE AND BEANS

### 4.1.1 The Agricultural Economic Landscape

Market overview

The agricultural sector is the backbone of Kenya's economy. It directly contributes approximately 23% to Kenya's GDP and indirectly adds another 17% through its linkages with other sectors (Kenya National Bureau of Statistics, 2024). Crops contribute nearly 70% to the sector's GDP, ensuring food security for over 80% of Kenya's 47.7 million people and enhancing nutrition through the production of safe, diverse, and nutrient-dense foods (FAO, 2024). Additionally, agriculture drives the non-agricultural economy by providing inputs for industry and mining, and creating markets for sectors such as construction, transportation, tourism, education, and social services.

The agricultural sector is also the largest source of employment in Kenya, with around 13 million people employed in 2019, representing about 54% of the total labor force and 70% of the rural population (United States Agency for International Development, 2023). This underscores the sector's critical role in providing jobs and supporting livelihoods.

Dominant farming practices:

- **Smallholder Farming:** Kenya's agriculture is predominantly characterized by small-scale farming, which accounts for approximately 75% of the total crop output. Smallholder farmers play a crucial role in this sector, primarily cultivating crops for home consumption while selling surplus produce for additional income. They typically operate on less than two hectares of land and grow a diverse range of crops, including maize, beans, potatoes, and various vegetables. Livestock farming is also common among smallholders, with many keeping dairy cows, goats, sheep, and poultry.

*Source: J. Warburton-Lee/Alamy*
*Figure 4-1: Smallholders Farming in Kenya*

- **Large-Scale Commercial Agriculture:** In addition to small-scale farming, Kenya has a significant commercial agricultural sector. Large-scale producers contribute substantially to the economy, particularly through the

production of key crops. According to the Kenya National Bureau of Statistics (KNBS), the primary crops produced by large-scale producers include:

- **Tea:** Kenya is amongst the top#3 major global tea producer. The tea market production increased from 1.23 billion US$s in 2022 to 1.40 billion US$s in 2023.
- **Horticultural Crops:** Exports of horticultural crops (such as flowers, fruits, and vegetables) increased from 1.16 billion US$s in 2022 to 1.22 billion US$s in 2023.
- **Milk:** Milk production in Kenya rose from 292.4 million US$s in 2022 to 324.4 million US$s in 2023.
- **Sugarcane:** Sugarcane market production increased from 224 million US$s in 2021 to 270 million US$s in 2022.
- **Beans:** Beans production increased by 1%, reaching a value of 894.8 million 997 in 2023.
- **Coffee:** Coffee production declined slightly to 157 million US$s in 2023.
- **Maize:** Maize production increased from 62 million US$s in 2022 to 89 million US$s in 2023.

The major cash crops grown in Kenya are tea, coffee, pyrethrum, cut flowers, macadamia nuts, avocadoes and passion fruits. Tea is the leading agricultural export commodity contributing about 28% of the total value of agricultural exports, followed by horticulture at 20%. In addition, tea accounts for about four percent of the country's GDP and employs about a tenth of the country's population when indirect jobs in the sector are included. (Mwangi J. Kanyua, 2015)

Internal-Export dynamics

The agricultural sector is crucial to Kenya's economy, accounting for 22% of the country's total trade value (Cowling, Agriculture in Kenya - statistics & facts, 2023). In 2020, the sector saw a notable improvement in the trade balance, with the deficit decreasing significantly. The value of marketable agricultural products also increased, highlighting the sector's growth. Domestic exports in 2020 grew primarily due to increased shipments of horticultural products and tea. Horticulture, which includes fruits, vegetables, and flowers, contributed significantly to export earnings, while tea remained a major foreign exchange earner.

These two categories together represent nearly half of Kenya's total export earnings. Despite its importance, the agricultural sector faces several challenges. Kenya's dependence on a limited number of export goods and trading partners makes it vulnerable to global competition. Most agricultural products are exported in raw and semi-processed forms, limiting their value addition. Market access is further impeded by several factors:

- **Limited adoption of online payment systems**: Both local and international markets lack comprehensive digital payment solutions, affecting transaction efficiency.
- **Insufficient logistics information**: There is a need for better information and infrastructure for efficient inland and maritime logistics.
- **Pests and diseases**: New agricultural pests and diseases pose a threat to production and export quality.

### 4.1.2 Maize Crop overview

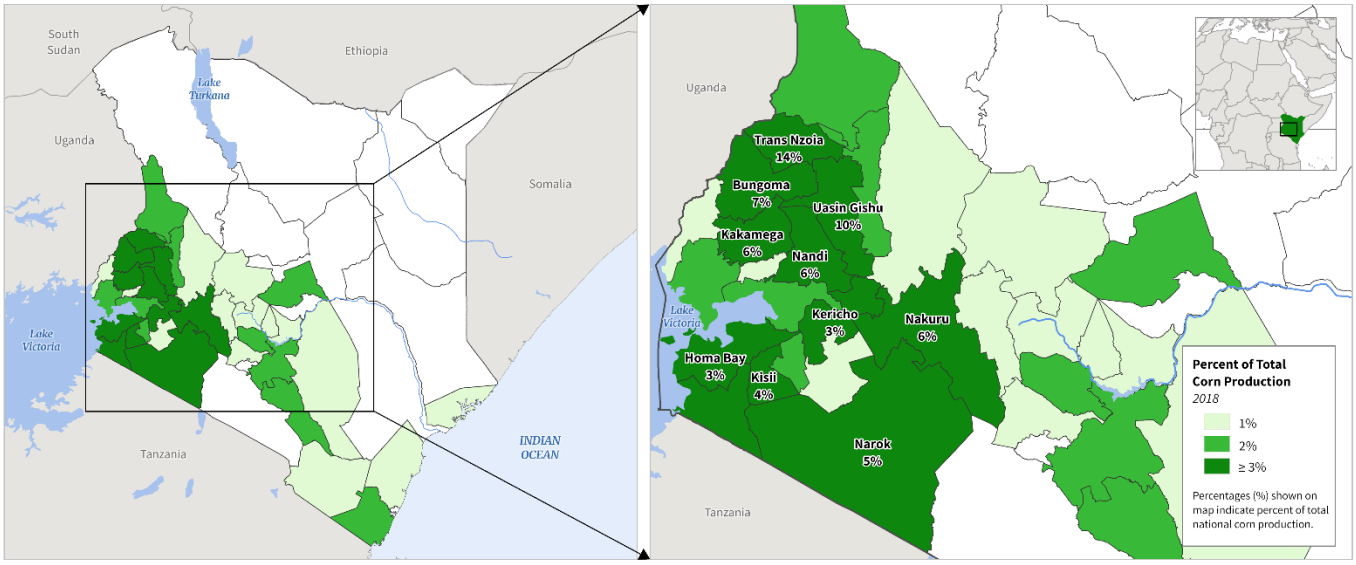
Market analysis: Maize (Zea mays L.) is the most important staple food crop in Kenya, feeding over 85% of the population. Each person consumes an average of 400 grams of maize daily. Maize contributes 3% to Kenya's overall GDP and 12% to its agricultural GDP (Kenya National Bureau of Statistics , 2019). The significance of maize extends beyond its role as a food source. It provides direct and indirect employment opportunities for over 90% of Kenyan farmers, making it a crucial element of rural livelihoods. Additionally, maize is essential in livestock farming, used as animal feed in the form of silage and bran. It is also a key raw material in the food industry, utilized in the production of cooking oils, cakes, and flour (Otieno, A review of

the Current State of Soil Infertility and Management , 2021 ). The maize sub-sector significantly boosts Kenya's economy through various channels. It contributes to foreign exchange earnings, provides a source of family income, creates employment, and enhances food security (Food and Agriculture Organisation, 2013). This makes Kenya one of the African countries with the highest maize consumption. Furthermore, maize farming supports various ancillary industries, fostering economic development. Its role in food security cannot be overstated, as it ensures a stable food supply for the majority of the population. The versatility of maize as both a food product and an industrial raw material underscores its importance in Kenya's agricultural landscape and its broader economy.
As for international trade, Kenya made approximately 5.13 M US$s on maize exports in the last year. On the other hand, the countries import of this very crop were equivalent to 170M US$s in the same period. (TrendEconomy , 2023)

Dominant farming practices and value chain: Maize production practices in Kenya vary significantly across regions, influenced by the climatic and socio-economic characteristics of the farmers. In Kenya, there is a gap between what is being produced and what is being consumed. (Allan Nyakora Masese, 2022). Although the total harvested area and grain production are increasing nationally, maize yields have remained relatively constant. This stability in yield trends, despite increasing production areas, is largely due to the diverse and often suboptimal farming practices employed across different regions. These practices are influenced by fluctuating socio-economic, environmental, and climatic conditions.

Farmers in Kenya typically experience low yields, averaging less than 2 tonnes per hectare, compared to the potential yields of over 5 tonnes per hectare achievable with well-managed systems.
Several factors contribute to these low yields, including limited access to quality inputs, inadequate extension services, and the adoption of traditional farming methods. Despite efforts from the government, non-governmental organizations, and the private sector to improve maize production through initiatives such as subsidized fertilizers, improved seeds, crop input funding, and extension services, these efforts have not significantly increased yields.

Regional focus areas: Maize is a warm-season crop that requires a minimum temperature of 10-15°C for germination and growth. In Kenya, the ideal climate for maize farming is found in areas with altitudes ranging from 900 to 2,500 meters above sea level. These regions receive a mean annual rainfall of 600 to 1,200 mm, well distributed throughout the growing season. Additionally, maize can be cultivated in drier areas with the help of irrigation. In Kenya, maize is cultivated across almost all agro-ecological zones, with more than half of household land dedicated to maize cultivation each season. Approximately 75% of Kenya's maize production comes from small-scale farmers, while large-scale farmers contribute around 25% (Kang'ethe, 2011). The Rift Valley is the major maize production area, with the following counties making significant contributions: Trans Nzoia (14%); Uasin Gishu (10%); Bungoma (8%); Kakamega (6%); Nandi (6%); Nakuru (6%); Narok (5%); Kisii (4%); Kericho and Homa Bay (3% each).




*Source: Maize Production 2018, Kenya Ministry of Agriculture*

***Figure 4-2: Total Maize Production***

### 4.1.3 Beans Crop overview

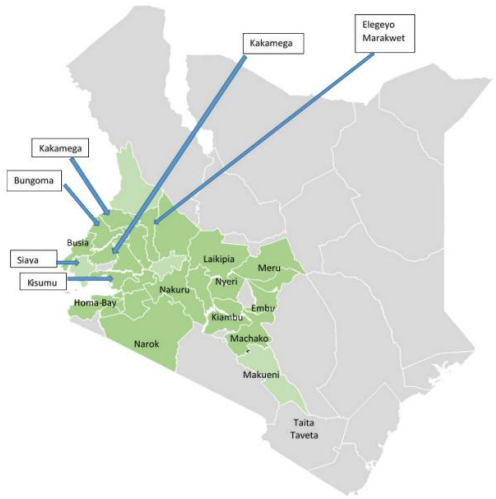
Market analysis: Kidney beans (Phaseolus vulgaris L.) rank as the second most vital food crop in western Kenya, following maize. Farming systems in this region blend crops, livestock, and trees for self-sufficiency. To combat bean root rot disease in the late 1980s and early 1990s, farmers turned to wild bean varieties from Rwanda, including KK8, KK14, KK15, KK20, and KK22, alongside Umubano, Gisenyi 2-Bis, Flora, Puebla, and Ngwinulare. These climbing beans, coupled with improved soil management practices, have been instrumental in boosting bean production. Kenya ranks as the seventh largest producer of kidney beans globally and the second in East Africa after Tanzania. Beans are a staple in Kenyan diets, with an estimated per capita consumption of 14 kg annually nationwide, rising to 66 kg in the western region. Although various parts of the plant are consumed, the dry grain remains the primary product. Beans are widely cultivated and consumed by middle- and low-income households.

With national consumption estimated at 755,000 tons annually and production at around 600,000 tons, Kenya bridges the consumption deficit through imports from Ethiopia, Tanzania, and Uganda (KCEP-CRAL, 2021). Production has shown a consistent upward trend since 2000, reflecting Kenya's efforts to introduce new technologies and resistant crop varieties. However, export patterns have been volatile, with peaks around 2016, coinciding with periods of increased imports, suggesting re-exporting post-processing. Notable investments, such as Japan's funding of a soybean sector project in 2013, indicate efforts to boost processing capabilities. Despite rising production, the per capita supply of beans decreased in 2021, potentially due to increased exports or population growth, signalling a need for further strategies to balance domestic demand and supply.

Dominant farming practices and value chain: In Kenya, various bean varieties are cultivated, including Rose Coco (known for its high yield, disease resistance, and versatility), Mwitemania, Wairimu, Mwezi Moja, Canadian W (an early-maturing variety with excellent cooking quality), KK15, and red and white kidney beans. The green beans, particularly popular, are predominantly grown by smallholder farmers under irrigation in Central, Rift Valley, and Eastern Provinces. Initially cultivated for export markets, green beans have gained popularity in domestic markets, notably in premium supermarkets. While a significant portion of green beans is exported, a substantial quantity remains for domestic consumption. For instance, out of

55,841 metric tons of French beans produced in 2010, only 34% were exported, valued at 43 million US$s (Horticultural Crops Development Autority, 2010). In 2011, French beans contributed 29% (approximately 39 million US$s) to Kenya's total vegetable export earnings of nearly 136 million US$s. Kenya has also developed a processing industry for beans, supported by both national and international funds. According to a study by (Babirye, Nakazi, & Abuchel, 2023), the bean processing market in Kenya displays oligopolistic tendencies, with four firms controlling 89% of the market. However, distribution appears to be more competitive, with four firms controlling 16% of the market. This market structure highlights both concentration and competition within the bean processing industry.

Regional focus areas: The main dry bean producing regions in Kenya are the Rift Valley and Eastern, Nyanza, Western and Central Kenya, accounting for 33%, 24%, 18%, 13% and 20% of the national production, respectively. Beans are grown almost exclusively by about 1.5 million smallholders on about 1 million hectares, with yields of about 600 kg per hectare (CRAFT, 2023). Although there are two growing seasons for common beans in Kenya, according to CRAFT (Climate Resilient Agribusiness for Tomorrow) report many farmers only grow beans once a year due to the harsh climatic conditions. In the Rift Valley and Western regions, land is allocated for growing beans once a year between March and May, while farmers in the Central and Eastern regions plant twice a year. However, only 70% of farmers in the eastern region grow beans during the rainy period. Almost all farmers in these two regions grow kidney beans during the second rain (October to December). During bad weather, production is limited in the east and coast of the country.




*Source: (Ministery of Agriculture, Livestock, Fisheries and Cooperatives )*
*Figure 4-3: Dry Bean Production in Kenya*

### 4.1.4 Post-Harvest Food Loss Analysis – Maize and Beans

In Kenya, food loss in beans during post-harvest processes is notable but not comprehensively quantified across all activities. However, household storage poses a significant issue, with losses ranging from 1.5% to 7.5%, primarily due to pests during storage, as noted by FAO and a study by Muhammad et al (2010).

For maize, drying and harvesting result in a 6.40% loss, with additional drying accounting for 4%. Shelling and threshing contribute to a 1.30% loss, household storage adds a 2.50% loss, and transportation from the field and to the market incurs losses of 2.40% and 1.70%, respectively, as reported by APHILIS.

## 4.2 E&S POLICY FRAMEWORK

### 4.2.1 Agricultural National Strategies

Kenya's agricultural sector is guided by key strategies to drive sustainable development and achieve national objectives. These include the Agricultural Policy 2021, Kenya Vision 2030, Agriculture Sector Growth and Transformation Strategy (ASTGS), National Cereals and Produce Board Strategic Plan (SP) 2023 – 2028, and the National Rainwater Harvesting and Storage Strategy (NWHSS).

Agricultural Policy 2021: The Policy provides a framework for sustainable development of the agricultural sector based on the requirements Constitution and provides a clear road map to the realization of Vision 2030 agricultural goals and targets. The policy guides the management of watershed development, agro-forestry, soil and water management, genetic resources, pasture development and conservation, rangeland rehabilitation and fisheries resources. It provides for inter-sectoral linkages across government agencies, private sector and other public bodies for the Sector's development. The Policy unbundles the National and County Government functions and provides a clear role for the private sector.

Kenya Vision 2030: Kenya Vision 2030 is a Kenyan development program aiming to raise the average standard of living in Kenya to middle income by 2030. The vision aspires to foster achievement of the Sustainable Development Goals. The Vision is based on three pillars: economic, social and political.

Kenya Vision 2030 identifies the agricultural sector as key to the economic pillar in poverty reduction and addressing inequalities. The six key growth drivers for achievement of the economic vision are identified as tourism; increasing value in agriculture; a better and more inclusive wholesale and retail trade sector; manufacturing for the regional market; business process outsourcing and financial services.

Agriculture Sector Growth and Transformation Strategy (ASTGS 2019 - 2029): The strategy outlines the government's commitment to agricultural reforms and presents plans to drive agricultural transformation and boost food security. To drive Kenya's transformation over the next 10 years, the ASTGS is anchored in three outcomes: increasing small-scale farmer incomes, increasing agricultural output and value-addition, and boosting household food resilience.

The National Cereals and Produce Board Strategic Plan (SP) 2023 – 2028: It is the premier policy blueprint which guides the Board in implementation of projects and programs for the period 2023/24 – 2027/28 Financial Years. The strategic plan considers global trends in agriculture, Africa's Agenda 2063, regional frameworks (such as the Common Markets for Eastern and Southern Africa), and national agricultural policies. NCPB has identified four key result areas/central themes that will drive the Board for the next five years. These include commodity trading and distribution, management of the National Strategic Reserves, provision of agricultural solutions, and strengthening institutional capacity.

National Rainwater Harvesting and Storage Strategy (NWHSS) (2020 – 2025): The strategy provides the strategic measures for achieving water security for Kenya towards the realisation of the national water policy priorities and vision 2030. The strategy outlines the sub-sector vision, strategic goals, objectives and strategies to guide the medium term (5-year period) achievements in water harvesting and storage in the public sector and domestic level in line with national water policies for water harvesting and storage.

### 4.2.2 Key Legislation

Legislation forms the backbone of Kenya's approach to sustainable land use and agricultural development. The Constitution of Kenya, 2010, anchors principles of equitable land management and conservation. Complemented by the Crop Act, 2013, and the Agriculture Act, 2012, these laws aim to boost agricultural productivity while conserving soil fertility. The Environmental Management and Co-ordination Act (EMCA) (1999 & 2015) reinforces environmental protection measures, including the requirement for Environmental Impact Assessments (EIA) for agricultural projects. Additionally, Sessional Paper No. 01 of 2017 on National Land Use Policy underscores the imperative of sustainable land utilization across all levels of governance.

The Constitution of Kenya, 2010: The Constitution of Kenya (GoK) 2010 is the overarching law that governs natural resources in Kenya. Chapter 5 of the constitution deals with land use and land tenure and in it are various articles that are relevant to soil fertility. Article 60 requires that all land (Private, Public and Community) be held, used and managed in a manner that is equitable, efficient, productive and sustainable, and in accordance with a set of principles including security of land rights; sustainable and productive management of land resources; sound conservation and protection of ecologically sensitive areas; and the elimination of gender discrimination in law, customs and practices related to land and property in land. Article 69 (1) (a) of the Constitution bestows on the State the responsibility to ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits. Article 43 of the Constitution affirms the right of every person to be free from hunger and to have food of acceptable quality and quantity.

Crop Act, 2013: This Act seeks to accelerate the growth and development of agriculture, enhance productivity and incomes of farmers and the rural population, improve investment climate and efficiency of agribusiness and develop agricultural crops as export crops.

Agriculture Act, 2012: An Act of Parliament to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry. It provides for the establishment of the Agriculture, Fisheries and Food Authority, which oversees the development and management of agricultural land. It also defines the roles of the national and county governments in agriculture and aims to conserve the soil and its fertility.

Environmental Management and Co-ordination Act (EMCA) (1999 & 2015): This law provides for environmental protection in Kenya. The Act requires an Environmental Impact Assessment (EIA) for certain agricultural projects or activities that may have significant environmental impacts. This assessment helps identify potential adverse effects on the environment and proposes mitigation measures. For example, large-scale irrigation schemes, agrochemical use, and land conversion for agriculture would fall under the EIA requirements. The Act emphasizes the protection and conservation of natural resources, including soil, water, and forests. Sustainable agricultural practices are essential for maintaining these resources.

Sessional Paper No. 01 of 2017 on National Land Use Policy: The principle objective of the policy is to provide legal, administrative, institutional and technological framework for optimal utilization and productivity of land related resources in a sustainable and desirable manner at national, county and sub-county and other local levels. The policy calls for immediate actions to addressing environmental problems that affect land such as degradation, soil erosion and pollution.

Kenya's Updated Nationally Determined Contribution (NDC) 2020-2030: The updated NDC moves from frequency and intensity of extreme weather events and successive impacts of climate change on Kenyan economy resulting to great socio-economic losses. Kenya has set out this Contribution to pursue its low carbon climate resilient development pathway

considering the country's dependence on climate sensitive natural resources. The updated document focuses on the revision process, both considering climate change reporting and the alignment of previous NDC with Sustainable Development Goals. The NDC seeks to abate greenhouse gases emissions by 32% relative to business-as-usual (BAU) scenario of 153 MtCO2e including LULUCF (143 MtCO2e using IPCC SAR values) by 2030 in line with Kenya's sustainable development agenda through a low carbon and climate resilient development pathway, The NDC focuses on sectors such as energy; industrial processes and product use; agriculture; land-use; forestry; waste, and dealing with the following gases: Carbon dioxide (CO2); methane (CH4); and nitrous oxide (N2O). This NDC faces the following adaptational risks primarily related to climate change impacts including threats to agriculture from erratic rainfall and extreme weather events, water scarcity health risks exacerbated by climate driven diseases, biodiversity loss and ecosystem degradation plus overarching challenges such as limited resources and institutional capacity.

### 4.2.3 Regulatory Bodies

The Ministry of Agriculture and Livestock Development plays a pivotal role in Kenya's agricultural landscape, overseeing policy formulation and implementation to ensure food security and rural livelihood improvement. Comprising four State Departments, it collaborates with county governments for effective program delivery. Supporting its mission are key institutions like the Agriculture and Food Authority (AFA), Kenya Plant Health Inspectorate Service (KEPHIS), Kenya Agricultural and Livestock Research Organization (KALRO), Agricultural Finance Corporation (AFC), Kenya Seed Company Limited (KSC), National Cereals and Produce Board (NCPB), and the Pests Control Products Board (PCPB). Together, these entities drive agricultural research, regulatory oversight, financing, seed production, market stability, and pest control, contributing significantly to Kenya's agricultural sector's growth and sustainability.

Ministry of Agriculture and Livestock Development**:** The ministry is responsible for formulating, implementing, and monitoring agricultural legislation, regulations, and policies. The mandate of the Ministry is to ensure 100% Food and Nutrition Security and to improve the livelihoods of rural Kenyans by transforming the sector to be competitive, commercially oriented and responsive to the economic needs of the country. The Ministry is currently comprised of four State Departments: Crop Development and Agricultural Research; Livestock; Fisheries and Blue Economy; and Cooperative Development. The Ministry is part of the National Government and is responsible for policy formulation, regulation and the creation of an enabling environment for investment and business operation by different actors while the 47 County Governments are each responsible for the direct implementation of agricultural programmes, projects and day-to-day activities to support farmers, pastoralists, fisherfolk, cooperators and other stakeholders.

Agriculture and Food Authority: Agriculture and Food Authority (AFA) is a State Corporation in the Ministry of Agriculture, Livestock, Fisheries and Cooperatives established by the Agriculture and Food Authority Act No 13 of 2013 to operationalize the Crops Act No 16 of 2013. The role of the Authority is to regulate, develop and promote scheduled crops value chains for increased economic growth in Kenya. The Food Directorate was established in August 2014 pursuant to section 11(1) of Agriculture and Food Authority Act 2013, with a mandate to regulate, promote and develop scheduled food crops which are broadly categorized into three:

- Cereals;
- Legumes; and
- Roots and Tubers.

Kenya Plant Health Inspectorate Service : The Kenya Plant Health Inspectorate Service's (KEPHIS) main responsibility is to assure agricultural inputs and produce are of good quality to prevent adverse impact on the economy, the environment and human health. KEPHIS handles all matters relating to crop pests and disease control and has laboratories to monitor the quality and levels of toxic residues in plants as well as soils and produce. It develops and implements standards on both imported and locally produced seeds and approves all importation licences for plants and seeds. It grades and inspects plants and plants produce at the ports of entry and exit, ensuring that injurious foreign pests, diseases and noxious weeds are not introduced into the country. KEPHIS is also mandated to implement the national policy on the introduction and use of genetically modified plant species, insects and microorganisms in Kenya. The institution further coordinates the release of superior and well-adapted varieties/cultivars to the farming community.

Kenya Agricultural and Livestock Research Organization: KARLO's mission is to conduct agricultural research through science, technology, and innovation to catalyse sustainable growth and development in agriculture and livestock. The organisation coordinates agricultural research in the country. Its mandate is to:

- Promote, streamline, coordinate and regulate research in crops, livestock, genetic resources and biotechnology;
- Coordinate and regulate research in crops and animal diseases;
- Expedite equitable access to research information and resources as well as promoting the application of the research findings and technology in the field of agriculture.

KALRO focuses on various aspects, including improving feed availability, researching sorghum varieties, and enhancing value chains in agriculture and livestock.

Agricultural Finance Corporation : Established in 1963, the Agricultural Finance Corporation (AFC) has been working towards sustainable agriculture by providing credit to farmers and related industries. AFC provides sustainable financing through participative and collaborative financial and non-financial interventions, innovations, technology and products. AFC is a leading Government Credit institution mandated to provide credit for the sole purpose of developing agriculture. AFC has achieved substantial progress in areas such as financial inclusion, credit provision, employment creation, wealth generation, and food security through its committed initiatives and community engagement programs.

Kenya Seed Company Limited: Kenya Seed Company Limited (KSC) is a state corporation that produces and markets top quality certified seeds with an overall objective of adding value to the farming business and contributing to food self-sufficiency in Kenya. KSC is a state-owned organization that focuses on researching, developing, and marketing quality certified seed. KSC products include over 60 Certified Seed Varieties of Maize, Pasture, Horticulture, Sorghum, Sunflower and Vegetable seeds suitable for different agro-ecological zones in the region. The company controls over 80% of the seed maize market in Kenya.

National Cereals and Produce Board: The National Cereals and Produce Board (NCPB) is a commercial State Corporation operating under the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives. Its primary mandate includes:

- Providing logistics support services to the government regarding food security matters;
- Conducting market intervention for grains and farm inputs on behalf of the government;
- Engaging in commercial trading of essential crops such as maize, rice, wheat, and various pulses (including beans and green grams); and

- Offering grain post-harvest services, including drying, grading, aflatoxin testing, pest control, cleaning, storage, warehousing, weighing, bagging, and clearing and forwarding.

NCPB plays a crucial role in ensuring food security by managing grain supply chains and facilitating market stability.

Pests Control Products Board: The Pest Control Products Board (PCPB) is a statutory organization established by the Kenyan government under the Pest Control Products Act, Cap 346, Laws of Kenya of 1982. The PCPB regulates various aspects related to pest control products, including potation, exportation, manufacture, distribution and safe use of pest control products. It aims to safeguard human health, the environment, and productivity while achieving Kenya's Vision 2030 goals. The PCPB maintains lists of approved chemical and non-chemical pest control products for use in Kenya. These lists include products that have undergone rigorous evaluation and meet safety and efficacy standards.

### 4.2.4 Emerging Regulation

Draft Fertilizers and Animal Food Stuffs (Fertilizers) Regulations: The Draft Fertilizers and Animal Foodstuffs (Fertilizers) Regulations are currently under consideration by the Ministry of Agriculture and Livestock Development in Kenya. These regulations aim to give effect to the provisions of the Fertilizers and Animal Foodstuffs Act (Cap. 345) and its amendments. Specifically, they regulate aspects related to the importation, manufacturing, production, and distribution of fertilizers and animal foodstuffs. The Regulatory Impact Statement (RIA) for these proposed regulations was prepared in accordance with the provisions of the Statutory Instruments Act, 2013.

Livestock Protection and Sustainability Bill, 2024: The Bill provides for livestock safeguarding from adverse conditions including drought, provide for sustainable practices to alleviate the effects of drought on livestock farmers and for connected purposes. The Bill establishes a National Livestock Feed Reserve to collaborate with counties and set standards for pasture water management and conservation of natural resources.

Draft Animal Welfare and Protection Bill 2019: The Bill was developed to replace the Prevention of Cruelty to Animals Act that was enacted in 1962 and revised in 2012 which governs matters of animal welfare in the country. The Bill seeks to improve on the existing Prevention of Cruelty to Animals Act and provide more enforceable sections aligning with animal welfare protection to international standards and guidelines.

## 4.3 ENVIRONMENTAL RISKS ANALYSIS

### 4.3.1 Water availability

Evidence shows that Kenya's agricultural sector is severely affected by climate change, particularly in terms of water availability. Over 90% of the country's agricultural activities depend on rainfall, making the sector highly vulnerable to fluctuations in weather patterns and prolonged droughts (P. Andati, E. Majiwa, M. Ngigi, R. Mbeche, & J. Ateka, 2023). Reliance on rain-fed agriculture significantly exacerbates the challenges posed by erratic and diminishing water supplies. Smallholder farmers, who form the backbone of Kenya's agricultural economy, are particularly vulnerable to these water availability issues. Lacking access to reliable irrigation systems, they depend heavily on seasonal rains to sustain their crops. When rainfall is inadequate or erratic, crop yields suffer dramatically, threatening the food security and livelihoods of these communities. Moreover, smallholder farmers often cultivate marginal land that retains less moisture, further intensifying the problem of water scarcity. Figure below shows the drought persistence heat map for Kenya.

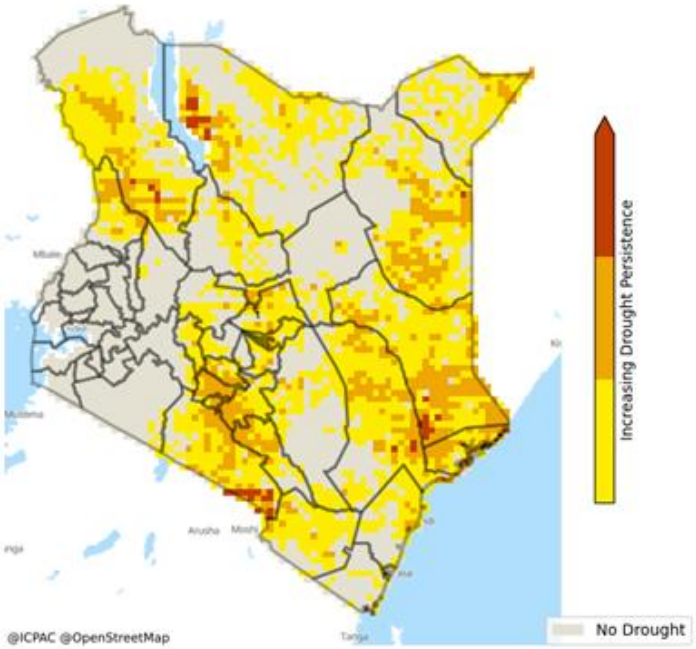
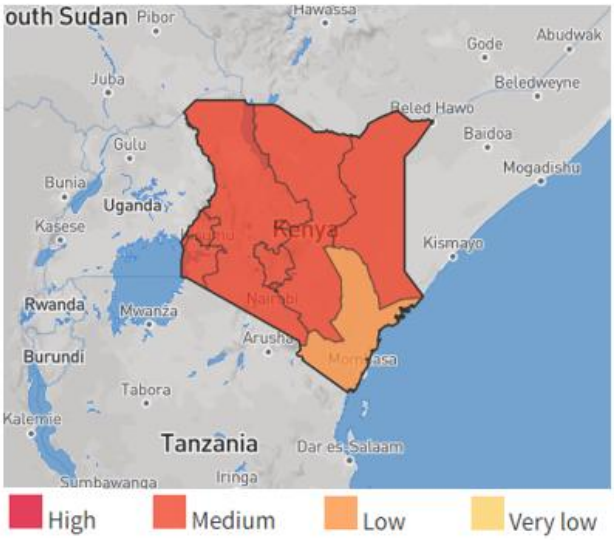



*Figure 4-4: Drought Persistence Heat Map*

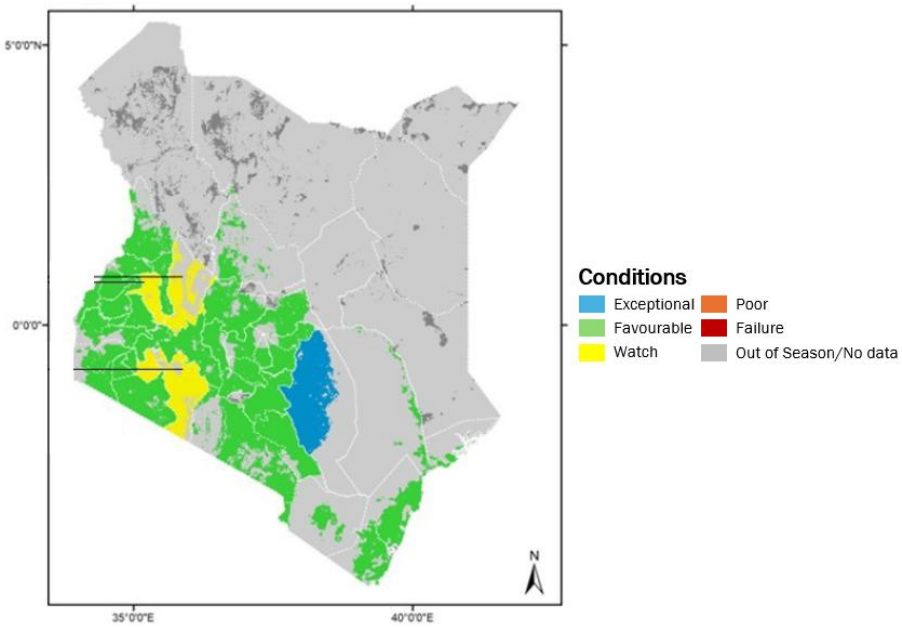
The *ThinkHazard!* tool also highlights the increased risks of drought in regions of the Rift Valley and Western Kenya, including Kakamega, Nandi, Vihiga, Kisumu, Makueni, Kitui, Embu, Tharaka Nithi, Nyeri, Nyandarua, and Laikipia (figure below)[8]. These areas are classified as having a medium level of water scarcity, indicating up to a 20% chance of drought occurring within the next decade. Given this information, it is essential to consider the potential impact of drought in all phases of the agricultural value chain, particularly concerning its effects on personnel and stakeholders.

[8] Please refer to https://thinkhazard.org/en/report/133-kenya/DG.




*Source: ThinkHazard!*
*Figure 4-5: Kenya - Water Scarcity level*

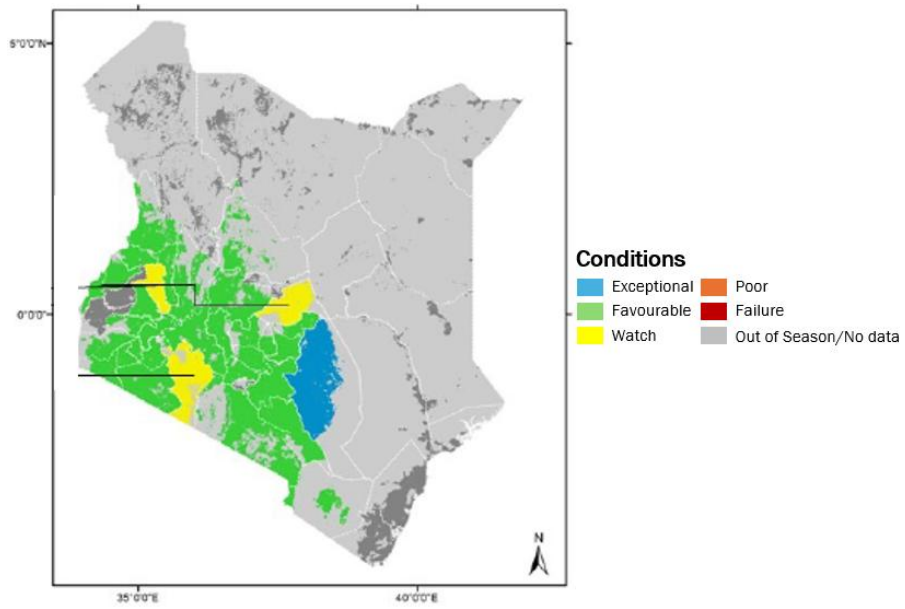
The impact of water scarcity is particularly evident in the production of staple crops such as maize and beans. Maize, a dietary staple in Kenya, requires a consistent water supply throughout its growth stages to achieve optimal yields. Irregular rainfall patterns can lead to poor germination, stunted growth, and reduced grain production. Consequently, growing conditions for maize can vary significantly across the country and from year to year. According to the Kenya Crop Conditions Bulletin (Ministry of Agriculture and Livestock Development, 2023), various regions in the country faced differing weather-related challenges in 2023. In Narok and Bomet, conditions were monitored due to excessive rainfall, while Uasin Gishu experienced prolonged dry spells. Samburu and Kitui faced erratic rains, and the Coast region, which initially suffered from delayed rainfall, saw improvement with the resumption of rains. A notable impact on maize production occurred in 2019, when output dropped from 44.6 million bags the previous year to 39.8 million bags, largely due to drought in several areas (National Environment Management Authority (NEMA) Kenya, 2021). Figure below shows the regions where maize production is concentrated and monitored by the Ministry of Agriculture. This crop monitoring map is based on a combination of variables, including remote sensing data, ground observations, field reports, and input from national and regional experts.




*Source: Kenya Crop Conditions Bulletin April 2023*
*Figure 4-6: Maize Long Rains*

Like maize, beans, an increasingly important food and cash crop in Kenya, are highly sensitive to water stress. Water shortages during critical growth stages, such as flowering and pod filling, can significantly reduce yields and affect the quality of the crop. Consistent water supply is crucial for maximizing soybean productivity, as water stress during these stages can lead to fewer pods, smaller seeds, and lower overall yields.

According to the Kenya Crop Conditions Bulletin of April 2023, conditions for beans are generally favourable across the country as the crop progresses from the early vegetative stage to flowering, with some counties reporting the onset of pod filling. However, specific regions are facing challenges. In Narok and Samburu, conditions are under observation due to erratic rainfall, which poses a risk to the crops during these critical growth periods. Similarly, the Coast and Kitui regions have experienced delayed emergence, potentially impacting the crop's development and overall yield.




*Source: Kenya Crop Conditions Bulletin April 2023*
*Figure 4-7: Beans Long Rains*

In summary, water availability is a critical issue for Kenya's agricultural sector. The reliance on rain-fed agriculture makes smallholder farmers particularly vulnerable to water scarcity, which threatens their productivity and livelihoods. Addressing this challenge requires a multi-faceted approach that includes infrastructure development and capacity building to ensure sustainable and efficient use of water resources in agriculture.

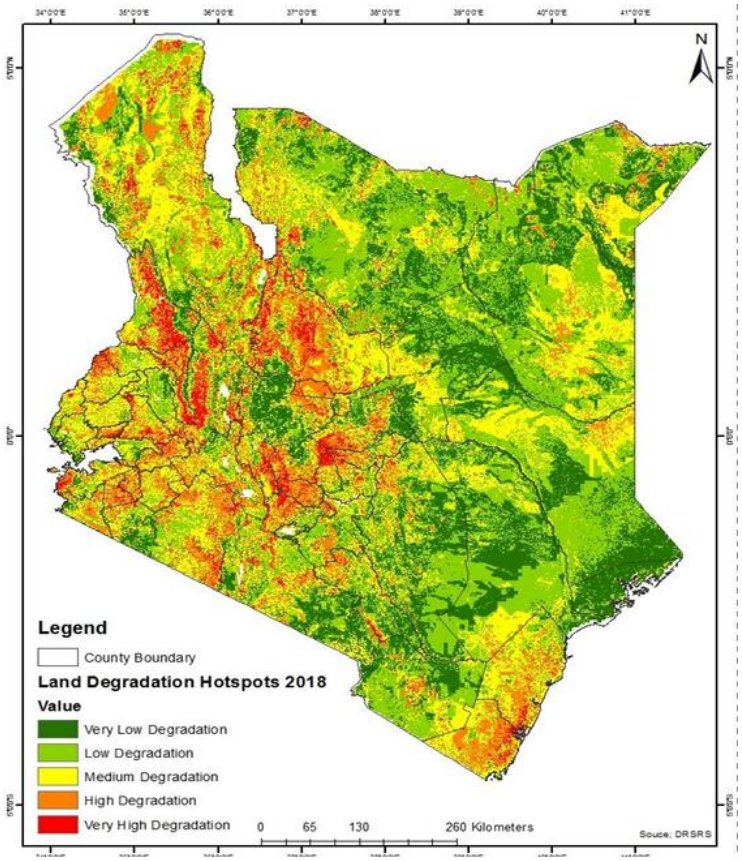
### 4.3.2 Land Degradation and Soil Erosion

The causes of land degradation in the tropics are a complex nexus of intense climatic conditions, steep slopes, poor agricultural practices, high erosion-risk soils, overpopulation, lack of appropriate policies and overreliance on subsistence crop farming. In Kenya, it is estimated that approximately 30% of landmass experiences severe soil degradation.

The dominant processes of land degradation that manifest in Kenya are the loss of soil fertility in agricultural lands through wind and water erosion, deforestation and desertification (Kogo, Kumar, & Koech, 2020). One estimate of soil loss from water erosion in Kenya was 72 tonnes per hectare per year. Another study reported a permanent reduction in soil productivity due

to water erosion in about 20% of Kenya's territory. Soil erosion often occurs on slopes near watercourses, in riparian areas and on marginal land. It is worth noticing that there is no single comprehensive method for mapping patterns, assessing status and quantifying the extent of land degradation in Kenya: Estimates of the extent of land degradation in Kenya vary depending on the source and method of calculation (Mulinge, Gicheru, Murithi, & Kihiu, 2015).

The figure below shows the land *degradation* hotspots according to the Land Degradation Neutrality (LDN) Target Setting Final Report (Republic of Kenya, 2017).




*Source: Land Degradation Neutrality Target Setting Final Report*
*Figure 4-8: Land degradation hotspot at watershed level*

The map above shows that high degradation level of land are concentrated in the eastern part of the country, especially in Nyeri, Embu, Tharaka Nithi and Nyandarua, where the maize production and partially beans production is concentrated.

According to the LDN Report, land degradation has multiple direct drivers, including:

- Improper management of the soil;
- Improper management of annual, perennial, shrub and tree crops;
- Deforestation and removal of natural vegetation;
- Over-exploitation of vegetation for domestic use;
- Overgrazing;
- Industrial activities, waste deposition and mining;
- Urbanization and infrastructure development;
- Discharges;
- Release of airborne pollutants;
- Disturbance of the water cycle;
- Over-abstraction of water; and

- Natural causes

There are also some indirect drivers from land degradation:

- Population pressure;
- Land tenure;
- Poverty/wealth;
- Labour availability; and
- Inputs access (including to credit/financing) and infrastructure.

Finally, it is important to highlight that this degradation of resources, including soil has both local and external costs. It affects food prices. According to the report Economics of Land Degradation and Improvement in Kenya (Mulinge, Gicheru, Murithi, & Kihiu, 2015), the total cost of land degradation on cropland is about 2.4 % of GDP in Kenya.

### 4.3.3 Soil Fertility and Acidification

Soil acidity is an important aspect of the edaphic factor that limits the production of any crop. Soil acidity affects the availability of critical plant nutrients, plant root growth and yield. There are several causes of soil acidity. Without human intervention, soils can become acidic due to natural causes, i.e., the mineral composition of the parent rock that formed the soil. In Kenya, this this natural process accounts for about 20% of soil acidity (Otieno, A review of the Current State of Soil Infertility and Management, 2021). The use of certain types of fertilisers can also increase soil acidity. In Kenya, the continued use of acidifying fertilisers such as diammonium phosphate (DAP) has led to an increase in the acidity of most soils in Kenya, particularly in maize growing areas. Yet this type of fertilizer is one of the top 3 fertilisers imported into the country (Ministry of Agriculture and Livestock Development, 2023).

The optimum soil pH for most food crops, including maize and beans, is a range of pH 6.0 - 7.0 for maize and 6.0-6.5 for beans (A.O. Esilaba, et al.). Although some crops can tolerate slightly acidic soils, a further decrease will reduce yields and profits. Figure below shows the Ph Classes Distribution in Kenya. Soil acidity is concentrated in the Central, Western, and Rift Valley regions – the main food baskets of Kenya. These include Kakamega, Nyeri and Embu.

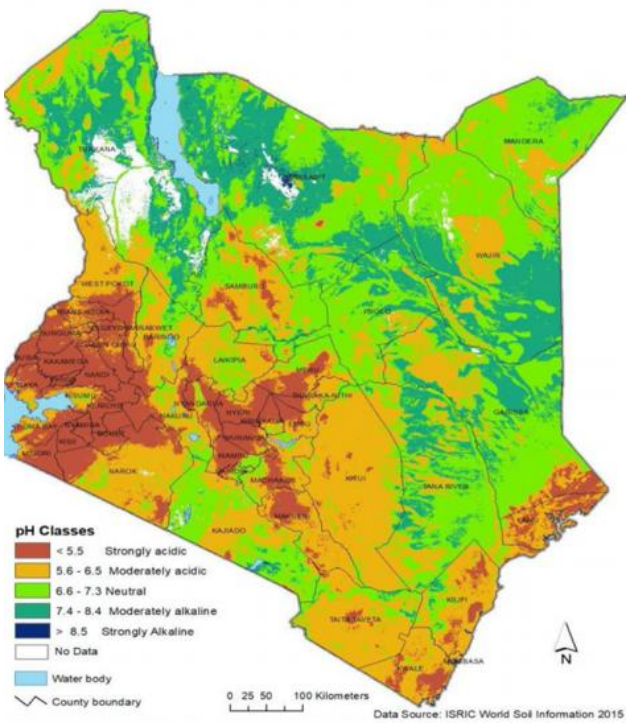



*Figure 4-9: Distribution of acid soils in Kenya*

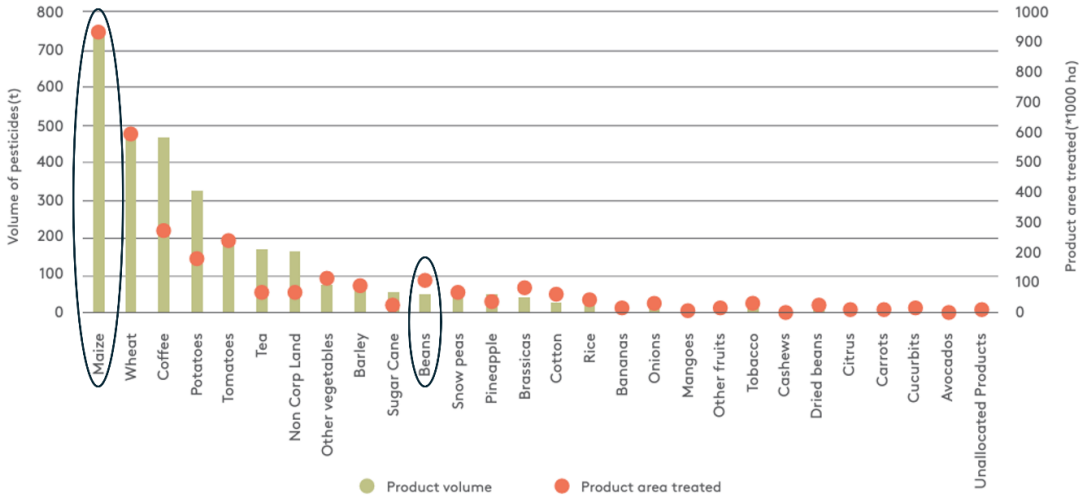
Inadequate soil fertility management has led to a significant decline in fertility over the years, resulting in low maize yields despite Kenya's growing population with high food demand. Despite high nutrient depletion, fertiliser use and adoption of soil fertility improvement practices by maize farmers in the country remain low.

Addressing soil acidity is crucial for enhancing agricultural productivity and sustainability in Kenya. By implementing a combination of liming, organic amendments, balanced fertilization, and improved crop management, farmers can mitigate the adverse effects of soil acidity and improve crop yields.

### 4.3.4 Pesticides use

The pesticide market in Kenya has experienced significant growth, which has raised concerns about the harmful effects of registered pesticides on human health and the environment. In 2020, farmers used a total of 310 pesticide products containing 151 active ingredients, according to the report Highly Hazardous Pesticides in Kenya (Bollmohr, 2023). They used 3,068 tonnes of pesticides to control insects, diseases and weeds on 26 different crops, including maize and beans. Of the 310 pesticide products used, 195 (63%) contained one or two active ingredients classified as highly hazardous pesticides (HHPs), accounting for 76% of the total pesticide volume used. This is an indication of the predominance of HHPs in the use of pesticides by farmers in Kenya, despite their known adverse effects.

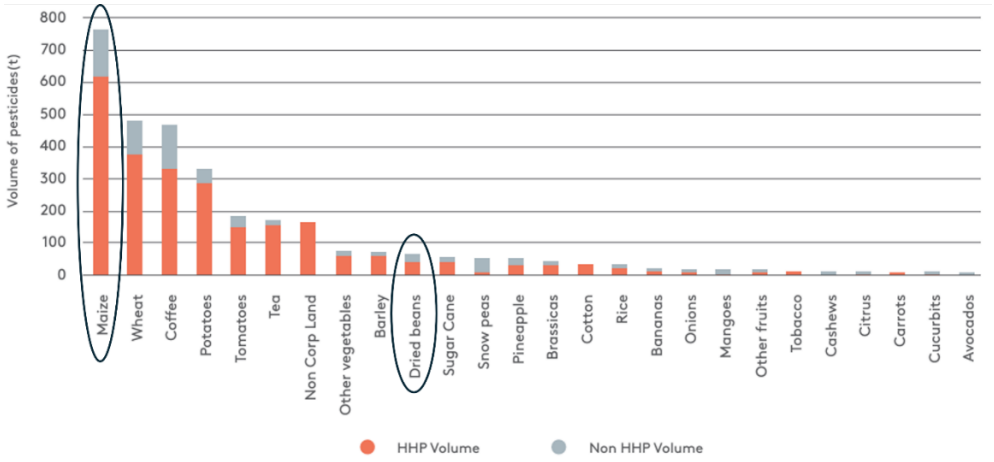
Notably, almost half (44%) of the total volume of pesticides used in Kenya are already banned in US$pe due to their unacceptable risk to human health and the environment. Maize requires the highest amount of pesticides, followed by wheat, coffee, potatoes and tomatoes, reflecting the large areas devoted to these crops. Beans rank eleventh in pesticide use, as showed in the figure below.




*Source: Highly Hazardous Pesticides Report 2023, Route to Food Initiative*

*Figure 4-10: Volume of products used on different crops in relation to area treated per crop*

Most pesticides used on different crops in Kenya are classified as HHPs, with non-HHPs accounting for only 22% of use. Maize production in Kenya relies on 40 different active ingredients for pest, disease and weed control, with 83% of the pesticide volume categorised as HHPs. Weed control is the biggest problem in maize production, with herbicides accounting for 86% of total pesticide use.




*Source: Highly Hazardous Pesticides Report 2023, Route to Food Initiative*

*Figure 4-11: Share of HHPs used on different crops in Kenya*

### 4.3.5 Deforestation

According to Global Forest Watch, between 2002 and 2023, Kenya lost 52.5 thousand hectares (kha) of humid primary forest, accounting for 14% of its total tree cover loss over the same period. The primary driver of this deforestation is the expansion of agricultural land. As the population grows and the demand for food increases, more forested areas are cleared to create space for crop cultivation and livestock grazing. This significant deforestation resulted in an 8.1% decrease in the total area of humid primary forest in the country. The deforestation impact is concentrated in specific regions, with the top six regions responsible for 52% of all tree cover loss between 2001 and 2023. Narok experienced the highest tree cover loss, with 76.9 kha, far exceeding the national average of 8.22 kha. This was followed by Kericho, Elgeyo-Marakwet, Baringo, Nandi, and Bomet. Nandi, in particular, lost 335 hectares of humid primary forest, which constituted 18% of its total tree

cover loss during the same period. Other regions experienced lower rates of decrease: Kisumu saw a 7.2% reduction, Kakamega 4.1%, Vihiga 3.4%, Embu 2.7%, and Kitui a minimal 0.21%.

### 4.3.6 Genetically Modified Crops

Kenya has recently lifted its 10-year ban on genetically modified organisms (GMOs), allowing the cultivation and importation of GMO crops, including maize and beans. This significant policy shift occurred in October 2022, following a recommendation from a task force set up to review issues related to GMOs and food safety. The decision aims to improve food security amid severe drought conditions that have drastically affected the country's agricultural productivity[9]. For maize in particular, the approval permits the introduction of GMO maize varieties that are drought-resistant and pest-resistant, crucial for improving yields and addressing food shortages. However, according to the FAO, this policy change will pose challenges at multiple levels, as Kenya currently faces significant issues in managing genetically modified food safety at scientific, political, and geographical levels. Despite guidelines separating risk assessment and risk management, GM food safety assessment often involves multiple levels and includes input from risk managers. The risk assessment process combines scientific issues like food safety and environmental concerns with non-scientific issues, allowing assessors to comment beyond their expertise. The National Biosafety Authority (NBA) lacks dedicated staff for GM food safety assessments, relying on ad-hoc assignments, which can lead to re-reviews by the NBA Board. Additionally, external experts often lack structured training for GM food safety assessment. To address these issues, the NBA has suggested establishing biosafety desks at each agency with trained core staff and experts, supported by tools like the FAO GM Food Safety Assessment Tools for Trainers (FAO, 2018).

[9] See https://www.foodbusinessafrica.com/kenya-lifts-10-year-gmo-cultivation-and-importation-ban/

## 4.4 SOCIAL RISKS ANALYSIS

### 4.4.1 Labour and Working Conditions

Risks associated with small holder farming: In Kenya, the labour and working conditions associated with maize and bean production pose several risks and challenges due to the smallholder farming practices of these two crops. Indeed, smallholder farming often involves issues related to wages and employment contracts. Many smallholder farmers work informally, which can lead to irregular or inadequate pay and a lack of formal contracts. This situation makes it difficult for workers to secure their rights and benefits, contributing to economic instability and exploitation.

Migrant workers: Kenya is a destination, transit, and origin country for migrants. As of 2019, over 4 million Kenyans have migrated within the country. The largest flow of internal migrants moves from rural to urban areas, drawn by employment opportunities in cities and access to better social services. Additionally, rural towns and secondary cities, which are emerging due to population and economic growth, are attracting many migrants. Migrant workers, often employed during peak farming seasons, face additional challenges. They sometimes endure lower wages and poorer working conditions compared to local workers. Furthermore, migrant workers may struggle to access healthcare and other social services due to their transient status and lack of formal employment. (FAO, 2017).

Occupational health and safety risks: Health and safety risks are significant in corn and bean production. Workers are often exposed to hazardous conditions, including prolonged exposure to pesticides, physical strain from manual labour, and the risk of injury from farm equipment. These risks are exacerbated by a lack of proper training and safety equipment, often due to the limited resources of smallholder farmers.

### 4.4.2 Human Rights

In Kenya, human rights within the agricultural sector, including staple crops like maize and beans, are crucial to the nation's socio-economic stability. These crops are essential for food security and the livelihoods of millions of smallholder farmers. However, numerous social challenges threaten the realization of these human rights, particularly concerning labour conditions and economic exploitation. A major issue is the poor working conditions that agricultural workers face. Those involved in the cultivation and harvesting of crops often endure long hours with minimal pay and lack essential protections such as health insurance and safe working environments. These conditions not only violate their basic human rights but also affect their health and productivity, perpetuating a cycle of poverty and exploitation.

Economic exploitation is another critical concern. Smallholder farmers often face challenges in accessing markets to sell their produce, relying heavily on intermediaries who exploit them by offering unfairly low prices. This economic exploitation diminishes their profits and discourages investment in improved agricultural practices, perpetuating a cycle of poverty. Inadequate infrastructure, such as poor roads and insufficient storage facilities, further exacerbates these issues by limiting farmers' ability to transport and preserve their produce effectively. Without proper storage, a significant portion of the harvest is lost, reducing the food supply and farmers' incomes.

### 4.4.3 Child Labour

The ILO has taken significant steps to eradicate child labour, notably through the adoption of Conventions 138 and 182. Convention 138 addresses the Minimum Age of Employment, aiming to prevent children below a certain age from being

engaged in work. Convention 182 focuses on the Worst Forms of Child Labour, seeking to protect children from hazardous activities that may harm their health or interfere with their education. Additionally, the African Charter on the Rights and Welfare of the Child emphasizes the protection of children's rights and urges state parties to prioritize the best interests of the child. Kenya has ratified these instruments, demonstrating its commitment to protecting children's rights. Children between the ages of 13 and 16 are only allowed to do light work. Kenya has also enacted various pieces of legislation, such as the Constitution of Kenya 2010, the Employment Act, and the Children's Act, which contain provisions to eliminate child labour. However, despite these legal frameworks, there is a pressing need for a child-centred policy specifically targeting the elimination of child labour. Child labour remains a significant issue in Kenya, particularly in the agricultural sector, which is the backbone of the country's economy (Daisy, 2017). While family labour is common in Kenya, approximately 1.3 million children, or 8.5% of the child population, are engaged in child labour in Kenya, many within the agricultural sector. This includes the cultivation of maize and beans. The primary causes of child labour are poverty, economic necessity, and lack of access to quality education. Maize farming is particularly labour-intensive, involving children in various tasks from planting to harvesting, especially in western regions like Kakamega and Nandi. Economic pressures compel families to involve their children in these activities, adversely affecting their education and overall well-being. Although soybean farming is less prevalent, children also participate in this sector where it exists[10].

Kenyan legislation also falls short of international standards because it does not limit the hours of light work, except for agricultural and horticultural work. As the minimum age for work is lower than the compulsory school age, children may be encouraged to leave school before completing compulsory education. In addition, although the Basic Education Act provides for free primary education and stipulates that children should not be denied admission to school on the grounds of non-payment of fees, the Act does not meet international standards because it allows schools to charge fees to children who reside in Kenya but do not have Kenyan citizenship[11].

### 4.4.4 Forced Labour

Forced labour remains a significant problem in Kenya, particularly in the agricultural sector. The ILO and other organisations have documented widespread cases of forced labour, affecting both adults and children. Key sectors include tea, coffee and sugarcane farming, where economic necessity and poverty force many families to engage in exploitative labour practices. Traffickers primarily exploit local and foreign victims in Kenya, and traffickers exploit Kenyan victims abroad. Within the country, traffickers exploit children through forced labour in domestic service, agriculture, fishing, cattle herding, street vending and begging[12].

### 4.4.5 Access to Land and Land Tenure

In Kenya, there are four main land tenure systems: private/modern, communal/customary, public/state, and open access. These systems involve various property rights regimes managed by the government, county councils, communities, and individuals. Individual property rights, such as freehold ownership, typically apply to land previously occupied by settlers or converted from customary holdings. Trust lands, which are not individually registered and were initially managed by local councils, accounted for about two-thirds of Kenya's land area in 1990. Since the 1990s, land reforms have sought to convert

[10] Refer to https://www.unicef.org/kenya/stories/lets-end-child-labour-kenya
[11] Refer to https://www.dol.gov/agencies/ilab/resources/reports/child-labor/kenya
[12] See https://www.state.gov/reports/2020-trafficking-in-persons-report/kenya/

trust lands into privately owned properties by formalizing existing claims. Pastoralist tenure is traditionally based on group membership, but increasing population, land values, and political pressures have led to the subdivision of group ranches into individual plots.

Smallholder farmers play a crucial role in Kenya's agricultural sector, often operating on land held under various tenure systems. These farmers face unique challenges, such as limited access to credit, agricultural inputs, and markets, which are compounded by land tenure insecurity. The individualization and privatization of land tenure have sometimes exacerbated these issues by creating fragmentation of land holdings, making it difficult for smallholders to achieve economies of scale and invest in sustainable farming practices.

From a gender perspective, these privatization efforts have often weakened women's land tenure security, as land titles are frequently allocated to men, undermining women's secondary rights. The 2010 Constitution aims to address these issues by promoting equitable access to land, securing land rights, eliminating gender discrimination, and encouraging local community-based land dispute resolutions (Djurfeldt, 2019).

### 4.4.6 Community Health and Safety

Community health and safety issues during the production of annual crops may arise due to land use changes or to the loss of natural buffer areas (such as wetlands, mangroves, and upland forests that mitigate the effects of natural hazards, such as flooding, landslides, and fire) that may result in increased vulnerability and community safety-related risks and impacts. The diminution or degradation of natural resources may result in health-related risks and impacts. Hazardous products, including pesticides, may affect community health in the same ways that they affect individual operators: through dermal contact, ingestion, or inhalation of harmful products or chemicals. Risk of exposure to hazardous products can be minimized by ensuring that the plantation group is following guidelines for the transportation, storage, handling, usage, and disposal of those products. Risks also arise from:

- Potential exposure to pesticides (e.g., spray drift, improper disposal and use of packaging and containers) and presence of pesticides or by-products in potentially harmful concentrations in foodstuffs and postharvest products.
- Potential exposure to pathogens and noxious odours associated with the use of manure.
- Potential exposure to air emissions from fires, burning of crop waste, residues, or solid waste (e.g., packaging).
- Increased risk of vehicle or machinery injuries on roads and access routes around the community.

## 4.5 GENERAL E&S RISK CONSIDERATIONS IN FL-RS INTERVENTION IMPLEMENTATION

In Kenya, the deployment of FL-RS must address key environmental and social challenges to ensure sustainable agricultural development.

Land Degradation: The introduction of FL-RS technologies, such as hermetic storage and biological control agents, can mitigate land degradation by reducing the dependence on harmful chemical inputs. Additionally, training on post-harvest techniques can encourage better land management practices, reducing soil erosion and maintaining soil fertility.

Labour Conditions: FL-RS interventions can improve labour conditions by reducing the physical demands on farmers, especially women and children involved in post-harvest activities. The provision of training and access to modern machinery will enhance safety and efficiency in farming operations, contributing to better labour practices.

Child and Forced Labour: The project's focus on promoting financial access to machinery and the establishment of farmer organizations can provide economic alternatives to child labour. By improving productivity and profitability, these interventions can reduce the economic pressures that drive child and forced labour in the agricultural sector. However, ongoing monitoring and engagement with local communities are necessary to ensure that these benefits are equitably distributed and that vulnerable populations are protected.

# 5 Malawi

## INTRODUCTION

**Malawi's agricultural sector is a vital foundation of its economy, significantly contributing to GDP, employment, and export earnings.** Maize, the staple crop, occupies 60% of cropped land and is essential for food security, accounting for 54% of caloric intake in households. Despite substantial production levels, challenges such as government subsidy inefficiencies, natural disasters, declining soil fertility, and high input costs have impacted food security. Smallholder farmers, who dominate the sector, also face unpredictable rainfall and pests (JICA, 2022; Robert Waterman, 2020). Groundnuts are another crucial crop, enhancing soil health through nitrogen fixation and providing significant economic potential. Predominantly grown by smallholder farmers, groundnuts face challenges such as aflatoxin contamination, limited access to quality seeds, and unstructured markets. Despite these challenges, both maize and groundnuts remain central to Malawi's agricultural sector, offering critical food security and economic benefits.

**The agricultural sector is shaped by comprehensive national strategies and legislation aimed at enhancing food security, economic development, and environmental sustainability (**see section 4.2). Key strategies include the National Agricultural Policy (2010), which focuses on food security, market development, and climate resilience, and the National Biodiversity Strategy and Action Plan II (2015-2025), which aims to manage biodiversity sustainably. The National Climate Change Management Policy (2016) and the National Irrigation Policy (2016) provide frameworks for climate adaptation and sustainable irrigation, respectively. The Agriculture Sector Food and Nutrition Strategy (2020-2024) promotes a well-nourished population through diverse food systems. Supporting legislation includes the Constitution of Malawi (1994), Environmental Management Act (2017), Irrigation Act (2001), and various acts regulating fertilizers, pesticides, and plant protection. Regulatory bodies like the Ministry of Agriculture and its departments oversee the implementation of these policies, ensuring agricultural productivity and sustainability.

**Malawi faces significant environmental risks, including vulnerability to climate hazards such as Cyclone Freddy, which recently damaged 28,000 hectares of maize and affected irrigation infrastructure in regions like Chikwawa and Phalombe.** The El Niño phenomenon has also brought drier conditions, threatening cereal production. Water availability remains low, with only a 1% chance of drought in the next decade, but the country is still prone to hydrometeorological hazards like droughts and floods, especially affecting maize cultivation (JICA, 2022; Robert Waterman, 2020). Land degradation and soil erosion are exacerbated by population growth, leading to cultivation in ecologically sensitive areas. Soil fertility varies across regions, with high levels of acidification affecting crop yields. Pesticide use, including banned chemicals, poses health risks, while deforestation driven by agricultural expansion and wood fuel demand further depletes natural resources. Social risks in Malawi's agricultural sector are also significant, particularly in labour and working conditions. Smallholder farmers, who predominantly produce groundnuts and maize, face challenges such as low productivity, dependence on rain-fed systems, and limited access to markets. These farmers often rely on manual labour, exposing workers to hazards like pesticides, sharp tools, and extreme temperatures. Additionally, many smallholder farmers and workers are not unionized, making them vulnerable to labour abuses such as poor working conditions and unfair wages. Migrant workers, essential during peak seasons, also suffer from poor conditions and lack of access to healthcare and education (IOM, 2022). Child labour remains prevalent, with about 2.1 million children involved, particularly in subsistence farming and tobacco production. Forced labour, though primarily associated with tobacco, could also affect other crops like maize and groundnuts. Land tenure issues,

stemming from weak land rights and land grabbing, further complicate the situation for small-scale farmers. Finally, the use of agrochemicals poses significant health risks to communities, as contamination of water resources can lead to severe health problems (ILO, 2018).

# LIST OF ACRONYMS

| | |
|---|---|
| ADDs | Agricultural Development Departments |
| AFOLU | Agriculture, forestry and other land uses |
| AGOA | African Growth and Opportunity Act |
| ASFNS | Agriculture Sector Food and Nutrition Strategy |
| ATCC | Agricultural Technology Clearing Committee |
| CEs | Customary Estates |
| CFT | Confined field trial |
| CLA | Customary Land Act |
| CO2 | carbon dioxide |
| COGA | Control of Goods Act |
| CRC | Conventions on the Rights of the Child |
| DAHLD | Department of Animal Health and Livestock Development |
| DAR | Department of Agricultural Research |
| DARS | Department of Agricultural Research Services |
| DARTS | Department of Agricultural Research & Technical Services |
| FAO | Food and Agriculture Organization |
| FOLU | Forestry and other land use |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GM | Genetically Modified |
| GSP | General System of Preferences |
| ILO | International Labour Organization |
| IMF | International Monetary Fund |
| LUANAR | Lilongwe University of Agriculture and Natural Resources |
| MITC | Malawi Investment and Trade Centre |
| MLND | Maize Lethal Necrosis Disease |
| MoA | Ministry of Agriculture |
| NDC | Nationally Determined Contribution |
| NES | National Export Strategy |
| NIP | National Irrigation Policy |
| PCB | Pesticides Control Board |
| POPs | Persistent Organic Pollutants |
| SAP | Structural Adjustment Programs |

## 5.1 PILLARS OF MALAWI'S AGRICULTURAL SECTOR: FOCUS ON MAIZE AND GROUNDNUTS

### 5.1.1 The Agricultural Economic Landscape

Market overview

Malawi's economy is primarily based on agriculture, which generates more than a quarter of the country's gross domestic product (GDP). This sector is pivotal for direct and indirect employment, economic growth, export earnings, poverty reduction, food security, and nutrition. Transforming agriculture into an engine of growth has been a long-standing development goal for Malawi (International Trade Administration, 2024). Agriculture accounts for over 80% of national export earnings and employs 64% of the country's workforce. It plays a critical role in ensuring food and nutritional security. However, despite its potential, Malawi's agricultural sector is currently operating below capacity.

The sector relies primarily on rain-fed crops, with minimal livestock production and consumption. Consequently, the country often faces food shortages at both national and household levels. Additionally, the infestation of the fall armyworm has significantly impacted maize production. The affected area increased from over 227,000 hectares in the 2019/20 season to approximately 296,000 hectares in the 2020/21 season, far exceeding the NAIP baseline and target of 5,300 hectares (JICA, 2022; Robert Waterman, 2020). Key crops in Malawi include maize, cassava, sweet potatoes, sorghum, bananas, rice, and Irish potatoes. These crops are vital for both food security and income generation for farmers. Livestock farming, including cattle, sheep, and goats, is also practiced in the country.

The agricultural sector faces several challenges, including vulnerability to weather impacts, poor land, water, and soil management, and low adoption of agricultural technologies. Farmers have limited access to finance, agricultural inputs, mechanization, technical skills, irrigation systems, and market linkages. Despite these challenges, there are numerous investment opportunities in Malawi's agriculture sector. These include livestock (dairy and beef), aquaculture, horticulture, agro-processing, sugar, soybean, cowpea, pork production, honey production, integrated cotton development, cassava production, and mushroom cultivation. These agricultural products can be processed and exported under trade agreements such as SADC, COMESA, the EU's General System of Preferences (GSP), the African Growth and Opportunity Act (AGOA), the General Tariff Preferential Treatment China, the Preferential Trade Agreement with India, the Preferential Trade Agreement with Japan, and the African-wide market through the AfCFTA.

Opportunities exist to expand irrigation and promote horticultural crops like vegetables, flowers, fruits, and rice, which can be grown using various irrigation systems such as surface, gravity, pump, diversion, drip, or sprinkler irrigation. There are also opportunities in providing agricultural products, equipment, processing machinery, and packaging. Moreover, investment in transformation units such as cotton ginning and spinning, fruit processing, beef and dairy processing, fishing and aquaculture, horticulture, pulses, oilseed production, and sugarcane product production can significantly benefit the local community's income. Innovative agricultural technologies are essential to improve yields, efficiency, and resilience to extreme weather and climate change. Engaging the private sector and smallholder farmers in sustainable agricultural practices and innovations offers the highest chance of success and contributes to value creation and trade efforts.

Dominant farming practices:

Malawi's agriculture relies predominantly on small-scale farming, representing 90% of the sector. The average size of smallholder farmer plots has decreased over time, from between 0.5 and 2.5 hectares in 2012 to approximately 0.32

hectares in 2016 of rain-fed land. These farmers face constraints such as declining soil fertility, unpredictable rainfall, pests, and unaffordable inputs. Yields are generally low, typically less than 1 ton per acre for maize, the main staple crop.
Historically, the primary approach in Malawi has been modernization, emphasizing synthetic fertilizers and agrochemicals to boost maize yields. Researchers have also explored agroecological principles, including legume varieties, maize-legume cropping systems, and botanical pesticides. By engaging farmers and expanding the range of context and farmer involvement through Farmer Research Networks, there is potential to enhance agricultural practices and outcomes (Agroecology Hub - Malawi, 2021)

The Malawian government aims to transform agricultural production through large-scale estate farming, known as "mega-farms." These mega-farms serve as centers for large-scale production and anchor points for surrounding communities. However, unpredictable government interventions and insufficient incentives have hindered large-scale production. Policies promoting collaborations between mega-farms and smallholder farmers, such as contract farming, are crucial. This type of investment can absorb labour and promote economic growth (Anderson Gondwe, 2022).

As Malawi aims to move away from rain-fed agriculture, creating opportunities for irrigation farming to increase added value is crucial. Innovative agricultural technologies are needed to improve yield, efficiency, and resilience to extreme weather conditions and climate change. Engaging the private sector and smallholder farmers in sustainable agricultural practices and innovations offers the highest chance of success and contributes to value creation and trade efforts.

Internal-Export dynamics

Like many sub-Saharan countries, Malawi suffers from a mismatch between food production and demand, making it a large net importer of food rather than a producer. This reliance on imports to meet food requirements impacts food security and economic stability and increases the national debt burden.

Malawi's imports primarily consist of animal products (meat, poultry, fish, eggs) and other food products like grains and oils (maize, wheat). Certain goods of national security significance require licenses as stipulated in the Control of Goods Act (COGA). The Ministry of Industry and Trade issues import and export licenses to help manage the trade balance and protect local industries.

Tobacco remains the most important cash crop in Malawi, accounting for over 40% of the country's annual export earnings. Other significant cash crops include dry pulses, sugar, tea, and nuts. The top exports of Malawi are raw tobacco (446M US$), tea (86.5M US$), ground nuts (83.7M US$), and dried legumes (59.15M US$), with primary export destinations being the United Arab Emirates (262M US$), Belgium (147M US$), Tanzania (74.78M US$), Kenya (60.27M US$), and South Africa (57.48M US$) (OEC, 2024). Although these cash crops are vital to the country's economy, maize remains the mainstay crop for smallholder farmers. It is grown in small rain-fed fields and features prominently on the country's political agenda. Other important cash crops include soybeans and cotton, which have readily available markets and are accessible choices for both small-scale and large-scale farmers (Anderson Gondwe, 2022). The country's dependence on food imports underscores the need for a balanced approach that promotes local production while managing necessary imports. Strategic policies and investments are crucial to enhancing agricultural productivity and reducing the reliance on imports, thereby improving food security and economic stability.

### 5.1.2 Maize Crop overview

Market analysis: Improving the productivity of smallholder farmers is recognized as a key component in the effort to reduce global poverty and increase food security. In Malawi, maize (Zea mays) has been the focus of national agricultural policies, as it is the major staple food crop. Approximately 60% of the total cropped land is devoted to maize production, which accounts for about 25% of agricultural employment, making it a significant income-generating crop (Orant Charities Africa, 2024).

The country's food security relies heavily on maize, as per capita consumption accounts for about 54% of the caloric intake of households in Malawi (Minot, 2010). Poor maize harvests can quickly lead to famine and food shortages. In recent years, maize production has been substantial: 3.4 million tons in 2018, 3.3 million tons in 2019, and 3.8 million tons in 2020. However, this has not translated into food security. The government's allocation of approximately 75% of the agriculture budget to subsidies and maize purchases has resulted in inefficiencies related to crop diversification, fiscal burden, and the promotion of a monoculture production system (Blessings Botha, 2020). Additionally, natural disasters have further impacted maize production. Cyclone Freddy, for instance, damaged about 28,000 hectares of maize crops in the southern region, which is about 5% of the maize area in the region covering 13 districts, according to official estimates (FAO, 2024).

Dominant farming practices and value chain: Malawi has 29 maize varieties, growing in various colors and lengths. Almost all maize production in Malawi is rain-fed and carried out by small farmers. These smallholders occupy around 54% of cultivated land in the country, with an average farm size of 0.5-0.8 hectares. Maize is grown during the rainy season from November to April. The sowing season is from mid-November to late December and the harvest season is from late April to late July. The actual harvest time depends on the agricultural practices of the individual farmers and above all on the onset of the rainy season, which is influenced by the location of the farm, the altitude and the local weather conditions.

Source: iybssd, 2022

*Figure 5-1 Maize Farmer*

In Malawi, several maize varieties are grown to address different needs. Here are some examples of the most popular ones:

- **Biofortified Maize (Pro Vit A):** these varieties are specifically bred to address vitamin A deficiency. They provide an essential nutrient while serving as a staple food. It is grown across Malawi, especially in areas where vitamin A deficiency is prevalent as it can adapt to various climates. However, it thrives in regions with adequate rainfall and moderate temperatures;

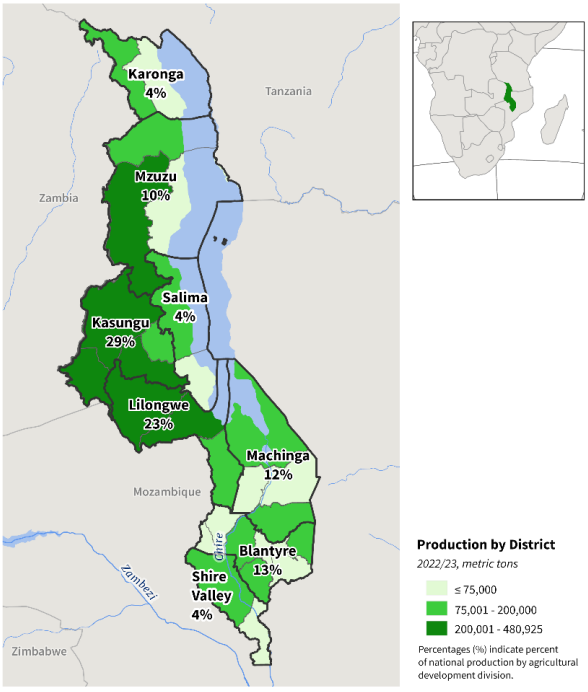
- **Dekalb Maize Seeds:** these varieties offer high yields and good grain quality. They are suitable for both subsistence and commercial farming. They are widely cultivated in central and southern Malawi. But prefer well-distributed rainfall and moderate temperatures;
- **Seed Co Maize Varieties:** these hybrids are known for their yield potential and disease resistance. They are Grown in various regions, including Lilongwe, Blantyre, and Mzuzu. And are adaptable to different climates, but optimal growth occurs with consistent rainfall; and
- **MLND Tolerant Hybrids:** these hybrids resist Maize Lethal Necrosis Disease (MLND) and other pests, ensuring better yields. Widely adopted by smallholder farmers across Malawi. And thrive in areas with moderate rainfall and well-drained soils.

There are also other less popular varieties that cater local preferences, culinary uses and market demands that are grown throughout the country, with variations based on local tastes.

The main areas of concern in the country's maize value chain are insufficient storage facilities and relatively high trade margins and intermediation costs along the value chain due to high transport costs. Inorganic fertilizers and other agricultural inputs are expensive mainly due to high trade margins resulting from high international and domestic transport costs, and the high trade risks associated with trading agricultural inputs. In 2023, facing high fertilizer prices, Malawi imported smaller fertilizer volumes, including supplies for its Affordable Inputs Programme[13]. High input costs are therefore likely to further reduce the use of fertilizers and improved seeds, which in turn reduces the use of improved technologies. This is the main reason for the low capitalisation of smallholder management systems, which inhibits technological and institutional innovation (Nelson Mango, 2018).

[13] The AIP is a program that allows Malawian subsistence farmers to purchase farm inputs at a subsidized cost with the government paying over 70%.

Regional focus areas: Maize is the dominant crop all over the country, but mostly in Southern Malawi which is also the most populated and cultivated region (Anghileri, Polite Chibarabada, Gadedjisso-Tossou, & Craig, 2024). The Central Region is the primary maize production area, accounting for 59% of total production. The Southern Region, despite having 45% of the country's population, contributes only 17% of total maize production. It's also considered the main deficit area as indicated by FEWSNET reports.




Source: USDA, 2023

*Figure 5-2 Regional maize production*

### 5.1.3 Groundnuts Crop overview

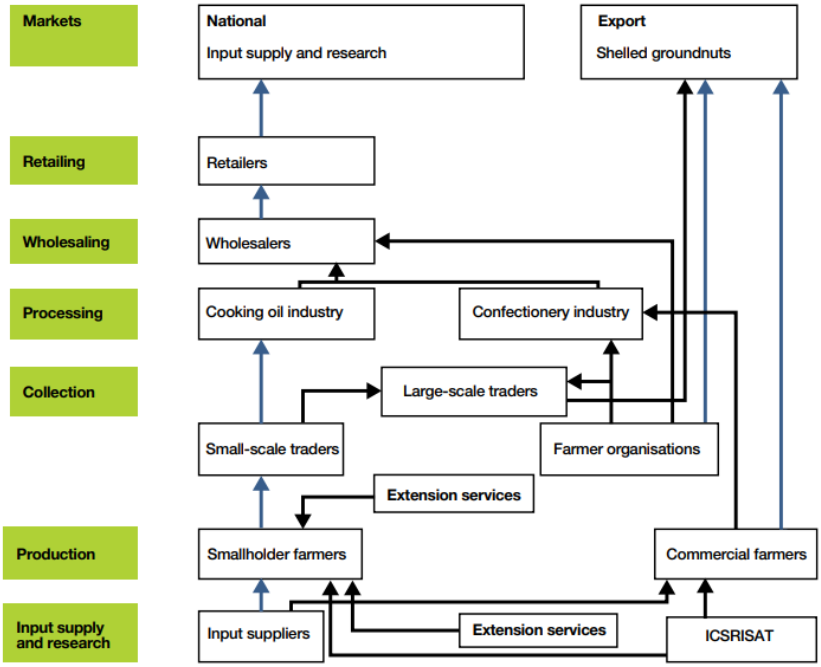
Market analysis: Groundnuts are one of Malawi's most important crops, and the central region of the country is particularly well suited to growing groundnuts. Historically, the plant has been grown by smallholder farmers and widely promoted for its positive effects on soil fertility, household food and income security, and as a supplementary feed for livestock (UNDP, 2024).

Groundnuts (Arachis Hypogaea) play a crucial role in the country's food supply due to their high nutritional and dietary value, as well as their ability to provide income for farmers contributing about 25% of agricultural income. Moreover, they can be utilized as feed for livestock, and its haulms can be used as fodder and fuel. In Malawi, an average of 310,000 tonnes of groundnuts are produced on 317,000 hectares of land. The country's average productivity is higher than in Africa (940 kg/ha) but lower than the world productivity (1,660 kg/ha). This crop is one of the most important crops for Malawi's agriculture sector. Its cultivation promotes crop diversification beyond maize as a staple food and tobacco as a major crop to reduce vulnerability to external shocks such as fluctuations in global demand (Malawi Investment and Trade Center , 2024).

Dominant farming practices and value chain: Groundnuts are a vital crop in Malawi, providing food and nutrients, improving soil health through nitrogen fixation, and potentially enhancing the trade balance through increased exports to regional, Asian, and US$pean markets. The National Export Strategy (NES) and Malawi Investment and Trade Centre (MITC) have identified significant export opportunities for groundnuts, estimating an untapped potential of about USD 25 million in markets across Africa, Asia, and US$pe (Dinah Salonga, 2023).

Groundnuts in Malawi are predominantly grown by smallholder farmers, who play a crucial role in both the area cultivated and the volume produced. Approximately 40% of the total groundnut production is marketed, underscoring the economic importance of this crop. Smallholder farmers typically cultivate plots ranging from 0.5 to 2 hectares, which are often family-run and contribute significantly to the country's peanut production (USAID, 2015). In terms of production systems, groundnuts are primarily rain-fed and grown either as a sole crop or intercropped with cereals and legumes such as maize, sorghum, and foxtail millet (FAC ICE Team , 2018). This intercropping practice not only optimizes land use but also enhances soil fertility and crop diversity.

The Groundnuts value chain in Malawi has evolved significantly since the early 1990s, primarily driven by the introduction of Structural Adjustment Programs (SAP) in the agricultural sector, led by the World Bank and the International Monetary Fund (IMF). These programs have triggered transformational changes in the peanut value chain, promoting market-oriented reforms and increased private sector participation. Additionally, some of the changes that have occurred are in response to challenges posed by the implementation of the SAPP[14] guidelines. the figure shows the current state of Malawi's peanut value chain since the introduction of SAPP (APRA, 2021).




Source: Forest Ra, 2015

*Figure 5-3 Groundnut value chain*

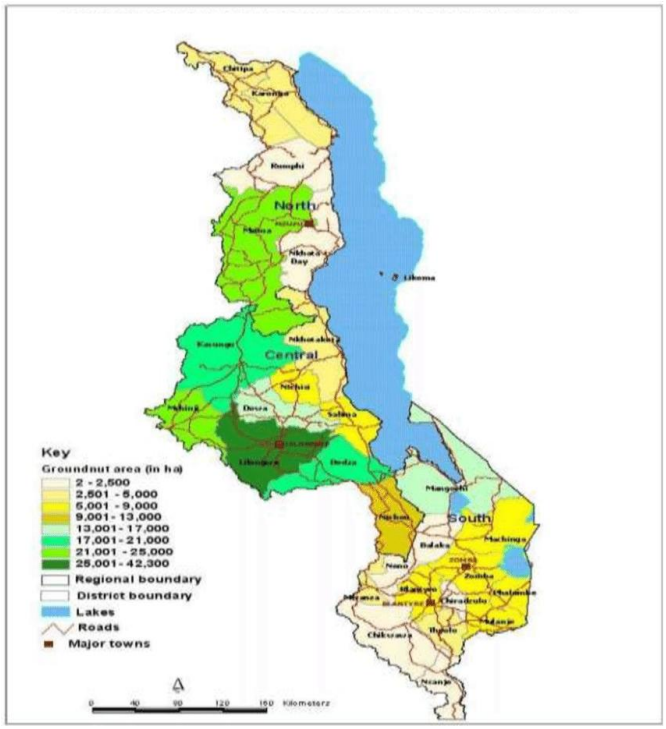
Malawi's groundnut value chain faces several challenges that affect different levels of the chain, from production to processing and marketing. To state a few:

- **High level of aflatoxin contamination:** Aflatoxin contamination is a significant issue that affects groundnut safety and limits cross-border trade. Contamination begins in the field and worsens post-harvest due to improper handling, high temperatures and long storage periods. Techniques to control aflatoxins, such as biological pest control (Aflasafe), proper drying, sorting and storage techniques, are poorly understood and underutilized (Limbikani Matumba, 2014).

[14] The Sustainable Agriculture Production Programme (SAPP) is being implemented in Malawi within the Government of Malawi's Sector Wide Approach (ASWAp) over a nine-year period. It focuses on improving agricultural techniques, seed multiplication, and small stock pass-on programs. https://www.sapp.mw/

- **Lack of access to improved seeds:** High quality seeds are essential for high productivity, but Malawi's groundnut seed system is complex and does not effectively support smallholder farmers. Challenges include a shortage of quality seeds, low seed reproduction rates, and reliance on recycled seeds. Recycling seeds beyond three generations is not recommended, but high costs discourage farmers from purchasing new seeds.
- **Limited access to profitable structured markets:** Many farmers grows groundnuts for self-consumption rather than market, using low-quality inputs and recycled seeds, and ignoring the risk of aflatoxins. Most commercially available groundnuts are processed domestically or exported informally, with unstructured markets and minimal quality control. Formal export markets require strict quality controls, including low aflatoxin levels, and require vertical integration of companies for better control and quality assurance (Scripts, 2014).
- **Limited consultation with the private sector:** The private sector is often excluded from consultation in the development and implementation of agricultural policies and regulations. This exclusion creates an unpredictable political environment and legislation that can negatively impact business operations. Lack of stakeholder engagement also means missed opportunities to address issues important to private sector growth.
- **High electricity costs:** High electricity costs and frequent power outages disrupt business operations. Electricity prices are charged based on maximum demand and are not deducted when consumption decreases, leading to inefficiencies and increased costs. Investment in alternative energy sources is expensive and inefficient, discouraging investment and making Malawian products less competitive.

Regional focus areas: Groundnut is grown throughout the country, but the Central and Southern Agricultural Development Departments (ADDs) of Kasungu, Lilongwe, Kasungu, Machinga and Blantyre accounted for over 75% of the total area under groundnut cultivation between 2001 and 2006. The figure below shows an overview map of the major groundnut growing areas in the country. Malawi's groundnut productivity remains low, mainly due to farmers continued use of unimproved/indigenous varieties and technical inefficiencies (Temesgen Bocher, 2017).




*Source: Bocher, 2017*

*Figure 5-4 Groundnut regional production*

### 5.1.4 Post-Harvest Food Loss Analysis – Maize and Groundnuts

In Malawi, maize experiences food losses during various stages of the post-harvest process. Drying and harvesting result in a 6.30% loss, while additional drying adds 4% to the total loss. Shelling and threshing contribute to a 1.40% loss, and household storage causes a 4.20% loss. Transport from the field and to the market incurs losses of 2.40% and 1.60%, respectively, according to APHILIS.

Groundnuts in Malawi suffer significant losses, particularly due to inefficient post-harvest practices. Lifting causes a 6% loss, drying contributes to a 5% loss, and shelling results in a substantial 11% loss, primarily due to inefficient machinery. Household storage is particularly problematic, with a 15% loss due to ineffective storage structures. Transportation from the field causes a 14% loss, mainly due to spillage, as reported by the FAO Food Loss and Waste Database.

## 5.2 E&S POLICY FRAMEWORK

### 5.2.1 Agricultural National Strategies

National Agricultural Policy (July 2010): The goal of the policy is to contribute to the attainment of national food security, poverty reduction and national economic development objectives. The document outlines clear strategic policy provisions in agricultural sector issues including agricultural inputs and markets, food and nutrition security, agricultural extension, land resources management, crop production, fisheries and aquaculture management, livestock, agricultural markets development, gender, HIV and AIDS and agricultural development, climate change and environmental issues and biofuels and agricultural development. The 2016 NAP has eight priority areas including Food and Nutrition Security, which promotes agriculture-based approaches for improving nutrition.

National Biodiversity Strategy and Action Plan II 2015-2025: is a framework for action that will guide Malawi to sustainably manage its biodiversity. The Strategy outlines the status of the biological resources in Malawi and provides strategies, targets and actions to be taken to ensure their sustainable management.

National Climate Change Management Policy 2016: The Policy provides strategic direction for Malawi's priorities for climate change interventions and outlines an institutional framework for the application and implementation of adaptation, mitigation, technology transfer and capacity building measures

National Irrigation Policy (NIP) 2016: The NIP 2016 provides guidance to all stakeholders in Malawi in the implementation and provision of irrigation-related goods, works and services. NIP is a policy document that aims at addressing critical issues affecting the irrigation sector that include spatial and temporal water shortages; customary land tenure disputes; and poor operation and maintenance of infrastructure. Sustainable irrigation development, sustainable irrigation management and capacity development are the three main policy thematic areas the NIP 2016 addresses to make agriculture more sustainable.

Agriculture Sector Food and Nutrition Strategy (ASFNS) 2020 – 2024: ASFNS' goal is to achieve a well-nourished population that effectively contributes to national growth and development through sustainable and diverse food system. The specific strategic objectives of the strategy are:

1. To ensure stable availability of food from all the six food groups through sustainable and diversified production.
2. To ensure stable access to safe and nutritious foods.
3. To promote social behaviour change for improved dietary practices.
4. To promote gender integration, and women and community empowerment and participation for improved food and nutrition security.
5. To create and strengthen an enabling environment for effective delivery of food and nutrition programs.

### 5.2.2 Key Legislation

Constitution of the Republic of Malawi (1994): It is the overall basic law governing Malawi and it was adopted on 18th May 1994. Under article 28 (1) the right to acquire property alone or in association with others is guaranteed. Article 13 states principles of national policy: accord full recognition to the rights of future generations by means of environmental protection and the sustainable development of natural resources. The Constitution also affirms the prohibition of forced labour under Article 21 (Slavery, Servitude and forced labour).

Environmental Management Act 2017: An Act to make provision for the protection and management of the environment and the conservation and sustainable utilization of natural resources. Article 4 (1) of the Act affirms the right of every person to a clean and healthy environment with a duty to safeguard and enhance the environment. Part VIII of the Act prescribes the management of the Environment and Natural Resources such as rivers, lakes, wetlands, natural heritage sites, hilly and mountainous areas.

Environmental Management Bill 2016 and amendments (2013): A revised version of the Act which makes provision for the protection and management of the environment and the conservation and sustainable utilization of natural resources in Malawi (Government of Malawi, 2016).

Irrigation Act 2001: The Act outlines provisions for sustainable development and management of irrigation, protection of the environment from irrigation related degradations, establishment of the National Irrigation Board and an Irrigation Fund and other related irrigation matters. The National Irrigation Board has been assigned the following functions as follows advising the Government and other stakeholders on policy matters relating to irrigation and drainage and also, among other things, approve standards and guidelines for the development and management of irrigation and drainage. The Irrigation Fund is vested in and administered by the Minister. It is established for the development and management of irrigation and drainage. The Act provides for local community participation in development and management of irrigation and drainage by allowing the Minister to enter into irrigation management agreement with an irrigation management authority.

Agriculture (General Purposes) Act: The Act grants regulation-making powers to the Minister for purposes of the proper regulation of activities in the agriculture industry not otherwise regulated by or under another written law. The Act provides for such regulations including but not limited to the licensing of buying, selling or otherwise marketing of agricultural crops, including the exportation, the persons or class of persons to whom a licence may be issued; and the minimum or maximum price payable to producers of agricultural crops.

Agriculture (General Purposes) (Minimum Prices for Agricultural Crops) Regulations, 2020: The regulation establishes the minimum prices that a person with a valid licence under the agriculture produce (Marketing) Regulations, who buys or intends

to buy the Agricultural crops listed in the Schedule shall pay. The Agricultural crops listed in the Schedule include groundnuts (shelled and unshelled), wheat, beans (mixed and pure), cowpeas, maize, soya beans, etc.

**Water Resources Act 2013:** An Act to provide for the management, conservation, use and control of water resources; for the acquisition and regulation of rights to use water; and for matters connected therewith or incidental thereto.

**Fertilizer Act 2023:** It is a legislation that regulates fertilizer related aspects such as the registration, manufacturing, production, blending, distribution, importation and exportation of fertilizer. The act establishes the Malawi Fertilizer Regulatory Authority and defines the functions, powers, composition, meetings and other matters of the statutory body.

**Pesticides (Amendment) Act 2018:** Pesticides Act makes provisions for the control and management of the import, export, manufacture, distribution, storage, disposal and use of pesticides. This Act establishes the Pesticides Control Board as a body corporate and shall be responsible for the registration, control and management of all pesticides in Malawi.

**Plant Protection Act 2018:** The Act was established with provisions for the protection of plants, the establishment of the Plant Protection Unit; for the eradication of pests and diseases destructive to plants; for the prevention of the introduction and spread of pests and diseases destructive to plants and plant products; for the promotion of appropriate. The principles of plant protection stipulated under this Act are coordination, equivalence, transparency, risk assessment, principle for the purpose in relation to the level of phytosanitary protection, and adaptation to regional conditions.

**Seed Act, Chapter 67:06:** The Act sets out the minimum standards to regulate and control the production, processing, sale, importation, exportation and testing and further to provide for the certification of seed and for other matters incidental to or connected therewith. The Act establishes measures for the control of the quality of seeds, the recognition of plant varieties, the registration of sellers of seeds, the declaration of prescribed seeds by the Minister, the regulation of importation, exportation and placing on the market of seeds, the certification of seed and the establishment of a Seed Services Fund.

**Updated Nationally Determined Contribution (July 2021):** The Updated NDC presents the Government of Malawi's revised commitment to climate change mitigation and adaptation efforts from 2020 to 2040. Malawi has updated its NDC to set economy wide targets at reducing greenhouse gas (GHG) emissions by 2040. These targets include a 6% reduction in emissions unconditionally with an additional 45% reduction contingent upon receiving external support. Therefore, the combined reduction target, including both conditional and unconditional commitments, amounts to 51% decrease in GHG emissions compared to Business-As-Usual (BAU) levels by 2040. The coverage of the contribution includes the three main greenhouse gases carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O).

The sectoral scope of this NDC encompasses all emissions sources outlined in the IPCC 2006 Reporting guidelines, including emissions from energy, industrial processes and product use (IPPU), waste and agriculture, forestry and other land uses (AFOLU) but excludes sources from forestry and other land use (FOLU). Total emissions, excluding those from FOLU, were estimated at 9.33 million tCO2e in 2017. Agriculture represented the largest portion of these emissions at 5.07 million tCO2e, accounting for 54% of the total. Energy emissions followed with 2.34 million tCO2e, constituting 25% of the total, while waste emissions amounted to 1.67 million tCO2e, making up 18& of the total. Climate finance challenges in Malawi includes insufficient funds, a restricted domestic budget for implementation of climate actions and limited participation of the private sector in environmental and climate change initiatives.

### 5.2.3 Regulatory Bodies

**Ministry of Agriculture (MoA)[15]:** The Ministry is organized into several technical departments. It is a key government ministry in Malawi Government. It plays a crucial role in promoting agricultural productivity, sustainable land management, and food security. The overall objective of the ministry is to increase agricultural productivity and improve food security and sustainable agricultural growth and development. The mandate of the ministry includes promoting and accelerating broad-based, sustainable agricultural development policies that enhances economic growth and contributes to poverty reduction.

The MoA is responsible for policy formulation and regulation, the coordination of training and collaboration with other stakeholders in the agriculture sector, and supervision of parastatal organisations, for which it also guarantees loans. The MoA is supported by the following departments:

1. Department of Agricultural Extension Services
2. Department of Animal Health and Livestock Development
3. Department of Agricultural Research Services
4. Department of Irrigation[16]
5. Agriculture Planning Services
6. Department of Crops
7. Land Resources Conservation

**Department of Agricultural Extension Services:** The department mandate is to ensure provision of appropriate and quality agriculture extension and advisory services by all service providers for enhanced adoption of improved technologies and agriculture business management among clients and farmers of all gender categories. The overall goal of the department is to ensure that all farmers demand and access high-quality agriculture extension and advisory services.

**Department of Animal Health and Livestock Development (DAHLD):** DAHLD has three technical sections. Animal Production, Field Services and Diagnostic Research and Investigation. The Department also runs a referral central veterinary laboratory and two regional laboratories which conduct research, investigate and diagnoses animal diseases.

**Department of Agricultural Research Services (DARS):** DARS develops modern agricultural technologies and provides regulatory and specialist services in agriculture related fields. The department is responsible for generating and transferring demand-driven and market-oriented agricultural technologies and specialist services, through participatory and integrated approaches in order to increase and sustain agricultural productivity.

**Department of Crop Development:** It is responsible for the promotion of sustainable crop production through increased yields and expansion of hectarage for some selected crops. Its specific mandate is to address the knowledge gap at the frontline extension worker's level and specialized crop-based farmer organizations. It provides crop production technical services to enhance the effective diffusion of technologies released by the Agricultural Technology Clearing Committee (ATCC). The department also provides services for farm mechanization, migratory pest control, and seed certification.

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[15] Ministry of Agriculture
[16] The Department of Irrigation – PROSPERITY THROUGH IRRIGATION (doi.gov.mw)

**Department of Irrigation:** It is a technical Department in the Ministry of Agriculture and Irrigation and is responsible for development and management of irrigation and drainage infrastructure. The strategic objectives of the department are: increase land under sustainable irrigation, facilitate crop diversification and intensification, create an enabling environment for irrigated agriculture, optimize investment in irrigation development taking into account climate change, enhance capacity for irrigated agriculture, and promote a business culture in the small-scale irrigated agriculture sector.

**Department of Agricultural Planning Services:** The department is mandated to: provide guidance on preparation and implementation of agricultural policies, identify and prepare projects and programme proposals for the ministry, monitor and evaluate agricultural sector projects and programmes, coordinate agricultural marketing issues; collect, analyse and maintain agricultural statistics and databank coordinate the implementation of food security programmes, and analyse and advise the ministry on sectoral policies.

**Land Resource Conservation:** The Department is responsible for promotion of programmes that ensure proper management of land based natural resources for improved agricultural production and other uses in order to avoid sectoral land use conflicts and ensure sustainable socio-economic growth and development.

**Ministry of Agriculture, Irrigation and Water Development:** The Ministry is responsible for enhancing agricultural productivity and food security, provision of agricultural extension services, enhancement of livestock and fisheries productivity, promotion of diversification of agricultural production for domestic and export markets, improving agricultural markets, increasing national food storage capacity and reducing poor harvest losses.

**Department of Agricultural Research & Technical Services (DARTS)[17]:** It is a technical Department in the Ministry of Agriculture and Irrigation and is responsible for conducting research and generating technologies for increased and improved agricultural productivity. Previously recognized as Department of Agricultural Research (DAR) in 1964, DAR was a relatively small organization that was staffed mainly by expatriate scientists. DAR was restructured into the DARTS in 1993. DARTS is a professional institution with about 70 highly qualified and skilled indigenous scientists; a network of 16 research stations, experimental stations and sub-stations; and an excellent research infrastructure and facilities to facilitate agricultural productivity in Malawi.

The mandate of the authority include:

- Conducting research on all crop and livestock types, with the exception of tobacco, tea, and sugarcane; and
- Offering technical support and advisory services to farmers and stakeholders on soil and leaf tests, certification of seeds, and agricultural imports and exports.

**Pesticides Control Board (PCB)[18]:** It is a statutory body established by the Pesticides Act of 2000 amended in 2018 to control and manage the importation, exportation, manufacture, distribution, storage, use and disposal of pesticides in Malawi. It was initially operating under the MoA but migrated to statutory status in 2019. PCB monitors pesticide residues in agricultural produce which ensures food safety and quality and support international commodity trade. PCB's mission is to regulate pesticides life cycle through registration, issuance of permits, licences and enforcement in order to protect human and animal life and the environment.

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[17] Department of Agricultural Research & Technical Services [Home] (sdnp.org.mw)
[18] Home | Pesticides Control Board (pcb.mw)

**Malawi Fertilizer Regulatory Authority:** A statutory body established under Fertilizer Act 2023 to regulate and also license fertilizer operators to ensure access to high quality fertilisers by farmers. The main responsibilities of the authority are:

- To regulate the manufacturing, production, blending, packaging, storage, handling, transportation, sale and disposal of fertilizer;
- To regulate the importation and exportation of fertilizer and fertilizer raw materials;
- To register, license and accredit entities to participate in the fertilizer industry; monitor manufacturing, production, packaging, transportation and use of fertilizer in order to safeguard human life, animal life and the environment; and
- To promote domestic fertilizer manufacturing and production through use of locally available materials.

### 5.2.4 Emerging Regulation

**Seed Act 2022:** It is an act that regulates the release and registration of crop varieties in Malawi, the production, processing, certification and sale of certified seed and importation and exportation of seed. The act also provides for the establishment of the Malawi Seed Regulatory Authority and matters incidental thereto. The objective of the law is to put in place an effective seed system capable of meeting the needs of a wide range of farmers in a wide range of crop seeds, and to make the seed industry sustainable. This Act operationalization date was on 26 March 2024 as per the gazette extraordinary, dated 5th April 2024[19].

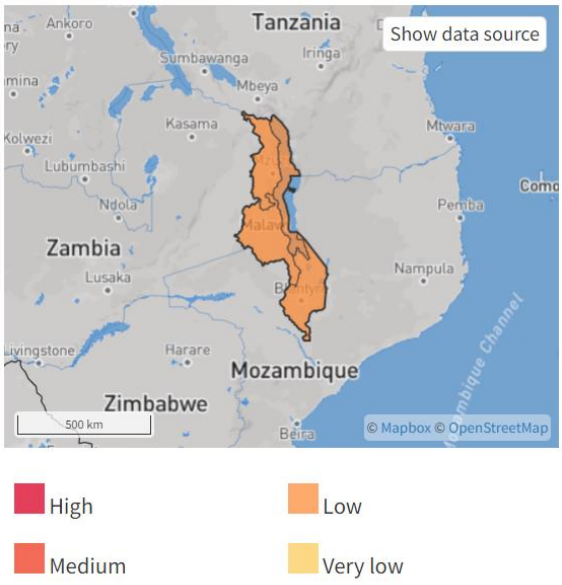
[19] Seed Act , 2022: Notice of Commencement - MalawiLII

## 5.3 ENVIRONMENTAL RISKS ANALYSIS

According to official estimates, Malawi is one of the southern African countries most vulnerable to climate hazards. Last year, Cyclone Freddy damaged approximately 28,000 hectares of maize in the southern region (about 5% of the maize area in the 13 districts of the southern region), as well as cash crops such as sugarcane and tea (FAO, 2023). In addition, the cyclone caused damage to irrigation infrastructure, especially in Chikwawa and Phalombe, which may negatively impact this year's produce. Furthermore, the El Niño phenomenon, prevailed from October 2023 to June 2024, expected to bring drier than normal weather conditions, creating downside risks to cereal production in 2024.

### 5.3.1 Water availability

Malawi water shortage is classified as low according to the data that's as of now accessible on ThinkHazard!. This means that there's a 1% chance drought will happen within the coming 10 years.




Source: ThinkHazard!

*Figure 5-5 Water availability*

The whole country is vulnerable to hydrometeorological hazards such as droughts and dry spells, as well as localized flooding. The southern region is characterized by semi-arid conditions with an average temperature of 25 °C and unimodal precipitation averaging 700 mm per year. Interannual variability in climate has increased in recent decades and is expected to be further affected by climate change, which, combined with increasing temperatures, will particularly affect maize cultivation.

Climate change is expected to increase the frequency of extreme weather events, and other climate threats experienced by Malawi (besides floods) are droughts. Observed temperatures in Malawi over the past 50 years suggest that there has been an increase of approximately 0.21 °C per decade (Kondwani Msowoya, 2016).

### 5.3.2 Land Degradation and Soil Erosion

Land has traditionally been the main source of livelihood and economic production in Malawi. However, the rapidly growing population exacerbates soil erosion. Significant soil losses could be mitigated if traditional agricultural patterns were replaced with improved agricultural systems that incorporate complete conservation and land use planning based on land management recommendations.

Population growth has led to the intergenerational fragmentation of land ownership, rendering traditional agricultural practices insufficient to produce enough food for the families they support. Consequently, cultivation has expanded into ecologically sensitive areas such as steep slopes, dambos, and riverbanks, often without protective measures.

As of 1987, an estimated 48% of the land was under cultivation, exceeding the area of land suitable for rain-fed agriculture under traditional management. The situation has worsened since then. Public lands in wildlife reserves and other forest-protected areas are under tremendous pressure from neighbouring villages. A recent land use survey classifying land use rights into traditional, public, and freehold sectors revealed that parts of traditional lands are underutilized and characterized by extensive idle lands. Additionally, the deregulation of burley tobacco cultivation has led to an explosion in the number of landholdings, significantly impacting both traditional and non-traditional land use rights (Dan, 2020).

Addressing these challenges requires comprehensive land management strategies, sustainable agricultural practices, and policies that support land conservation and the efficient use of land resources. Such measures will help restore land productivity, ensure food security, and protect the environment.

### 5.3.3 Soil Fertility and Acidification

Malawi's landscape is characterized by a variety of geological formations, including metasediments, sedimentary rocks, meta-basic rocks, and alkaline rocks. These formations release nutrients to plants in varying concentrations. Metasediments in northern, central, and southern Malawi are particularly rich in phosphorus, while granitic and alkaline rocks, especially in central and southern regions, are abundant in exchangeable potassium.

Malawian soils are generally classified into four main groups: Latosols (Chrome Luvisols), Calcareous soils, Hydrosoils (Haplic Lixisols), and Lithosols (Eutric Leptosols). The FAO provides a more detailed classification, dividing these soils into 28 classes.

- Latosols: These soils can be ferruginous (iron-containing) or ferrate (containing both iron and aluminum). They are prevalent in central Malawi and much of the Choros region. On the soil map of Malawi, Latosols are further categorized into Lixisols and Ferrasols.
- Calcareous Soils: Typically grey-brown, these soils are more influenced by drainage conditions than by temperature. They are commonly found in the lake plain, Bwanje Valley, and Lower Shire Valley regions. Subgroups of this soil type include Glacisols and Fluvisols (Malunga, 2022).
- Hydrosoils: These hydrophilic soils are usually black or mottled and exhibit high shrinkage and cracking when dry. They are primarily found in valley regions and include Vertisols.
- Lithosols: Characterized as young, flat, stony soils rich in quartz rocks, Lithosols are associated with quartz-rich rocks such as sandstone. Arenosols can also be classified within this group.

Among the 28 soil classes identified in Malawi, about seven major classes are highlighted. Their nutrient content varies significantly depending on factors such as parent material origin, horizon, topography, and sedimentation. The distribution of these soils is closely linked to the geology and topography of the region.

*Table 5-1 Malawi - types of soil*

| Soil Group | Area Coverage (Km2) | Land % |
|---|---|---|
| Lixisols | 24,169 | 25.8 |
| Luvisols | 20,115 | 21.5 |
| Cambisols | 16,633 | 17.7 |
| Gleysols | 5,765 | 6.2 |
| Fluvisols | 4,767 | 5.1 |
| Ferrasols | 4,024 | 4.3 |
| Arenosols | 2,135 | 2.3 |
| Vertisols | 1,387 | 1.5 |

Source: ISRIC Report 2016

Lixisols are distributed from north to south throughout the country, with Luvisols being more common in the central region, and Cambisols being more common in the northern and southern regions. Luvisols are well-drained soils with mixed mineral content and high nutrient content, suitable for a wide range of agricultural production. They are mainly the result of weathering of the biotite-quartz-feldspar gneiss that covers the main bedrock in the central and northern regions. Cambisols are characterized by the absence of a layer of accumulated clay, humus, soluble salts, or iron and aluminum oxides. The subsurface horizon has a sandy loam or finer texture with at least 8 percent clay by mass and a thickness of 15 cm or more. These soils are formed by decomposition of medium- to fine-textured rocks under such as charnokitic granulites and gneisses of the Shire highlands and Viphya plateau. Lixisols are soils with a high clay content sub surface from about 100 cm and occurring in drier areas of the tropical region. They have a base saturation of 50% of the total cation exchange of Ca, Mg, K and Na.

Although the countries soil is full of necessary nutrients for crop production, Malawi's soil suffers from high levels of acidification. This was disclosed by a ThinkThank a report that reported that 40% of Malawi's soil is in poor condition, with acidification cited as one of the main causes. With pH levels lower than 5.5 (V. H. Kabambe, 2012). High levels of acidity can affect both maize and groundnuts. When soil pH is too low (acidic), it affects nutrient availability and uptake by plants. Acidic soils can also reduce availability of essential nutrients like phosphorus, potassium and calcium. Which are required by both maize and groundnuts. Moreover, for both these crops, the optimum pH rang is between 6 and 7.5. Below pH 5.5, yields may decrease significantly.

### 5.3.4 Pesticides use

The majority of farmers in Malawi use pesticides to protect their crops from pests. Without the use of pesticides, farmers would not be able to achieve high yields. However, several studies around the world have shown that some of the pesticides used by farmers are harmful to health. A study published in Journal of Health & Pollution also found that farmers in Malawi continue to use some of the chemicals banned in 1984 and 1985. These pesticides include chemicals such as aldrin, chlordane, dieldrin, heptachlor, hexachlorobenzene, mirex, toxaphene, and dichlorodiphenyltrichloroethane (DDT). These chemicals are known to be persistent, and safer alternatives are preferred (Soko, Agricultural Pesticide Use in Malawi, 2018). Although the use of some persistent organic pollutants (POPs) is banned in the country, illegal use and trafficking of POPs is widespread in Malawi. The ministry of agriculture, irrigation and water development in Malawi reported the use of a number of prohibited pesticides (table below). Pesticides are also used in the post-harvest value chain, such as the use of rodenticides in the groundnut value chain to protect stored produce from rodent damage (FAO, 2018).

*Table 5-2 Some pesticides that are used by farmers in Malawi*

| Pesticide | Crop | WHO Classification (under specified dosage) | Specification |
|---|---|---|---|
| Aldrin | Maize (after harvest) | O | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |
| Chlordane | Maize (after harvest) | II | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |
| Dieldrin | Maize, seeds | O | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |
| Heptachlor | Maize | O | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |
| Hexachlorobenzene | Wheat seeds | Ia | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |
| Mirex | Maize | O | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |
| Toxaphene | Maize, Groundnuts, soybeans and sugarcane | O | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |
| DDT | Maize | II | Prohibited or severely restricted by the Stockholm Convention on persistent organic pollutants |

*Source: Jacob Jeketule Soko, 2018*

*Source: Farmer seeds*

*Figure 5-6 Pesticide use on maize*

### 5.3.5 Deforestation

Forests and woody plants contribute significantly to Malawi's economy. They account for 5% of the country's total wealth and 12% of its natural capital. However, these values will continue to decline as forest resources become increasingly depleted. Harvesting is estimated to be about 71% above the sustainable yield of forests. According to national income accounts, in 2010 the forestry sector contributed only 1% of value added. However, if non-commercial uses are taken into account, particularly firewood and charcoal (98% of the population relies on these for domestic energy), this figure rises to 7.9% (World Bank Group, 2019). Between 1972 and 1990, Malawi lost more than 40% of its forest area, and a further 15% of forest and tree habitat was lost between 1990 and 2005. Today, only 3% of Malawi is forested (Stephens, 2020).

Unsustainable land management and agricultural practices contribute significantly to deforestation. Mainly agriculture expansion, tobacco cultivation, and excessive biomass use contribute to deforestation in Malawi. Moreover, illegal logging and commercial-scale tree cutting are fueled by urban demand for charcoal within the country and international demand for hardwoods. This is due to the fact that Malawi heavily relies on wood for energy, as 89% of its population lacks access to electricity (Africa Geographic, 2019). Rapid deforestation has severe consequences for wildlife, biodiversity, ecosystems, and weather patterns. Recent flooding in southern Malawi highlights how land degradation can lead to tragic fatalities. Without intervention, Malawi could lose all its trees by as early as 2079.

New emerging initiatives are contributing to promote sustainable practices to protect the forest in Malawi. Initiatives include the National Charcoal Strategy (promoting alternative cooking fuels) and a new Forestry Bill (strengthening regulatory mechanisms and penalties for forest crimes).

*Source: gennaccollins.wordpress*

*Figure 5-7 Deforestation*

### 5.3.6 Genetically Modified Crops

Malawi has made great progress in the field of genetically modified (GM) crops. Thanks to a robust biosafety framework, the country is moving towards commercializing GM crops.

Maize: The country has initiated trials of GM maize to address recurrent hunger and pests like fall armyworms and caterpillars. These trials are ongoing at Lilongwe University of Agriculture and Natural Resources (LUANAR) and are currently in their first year, with the potential to extend up to seven years (Masina, 2024). However, it's important to note that while Malawi has

been more accepting of GM crops than its neighbours, no GM maize has been approved for commercial release yet (Food Safety Africa, 2024).

**Bt Cotton**: Malawi has successfully conducted a confined field trial (CFT) of Bt cotton at the University of Agriculture and Natural Resources (LUANAR). After three years of trials, Bt cotton will be commercially used. The pilot will be conducted in nine locations across the country. According to (Water Journalists Africa, 2021), Malawi's new cotton seed varieties seek to maximise production as opposed to conventional varieties, which have over years not benefited farmers. Even with short rains, farmers had a big reap in 2021 season.

Source: Waterjounalistsafrica

***Figure 5-8 Bt Cotton farmers***

**Bt Cowpea:** LUANAR is also trailing Bt cowpea to target the pest Maruca vitrata, a major threat to smallholder yields. The trial aims to evaluate the effectiveness of the Bt gene against this pest.After three years of CFT, the plan is to expand the trial to areas where cowpea is primarily grown.

**Virus-resistant bananas:** Malawi is facing the banana bunching virus that has devastated local banana plantations. To combat this, the country is conducting trials with virus-resistant bananas. These trials are still in the proof-of-concept stage and are supported by the Queensland University of Technology in Australia (CHAWEZA, 2017).

Information about genetically modified groundnut (peanuts) in Malawi is not readily available.

## 5.4 SOCIAL RISKS ANALYSIS

### 5.4.1 Labour and Working Conditions

Risks associated with Smallholder farming: Groundnuts and maize are mostly produced together in areas such as the Lilongwe-Kasungu plain, the Mchinji district in the central region of Malawi and some areas in Salima. Groundnuts is a low priority crop compared to maize which is a staple food in Malawi and tobacco a main crop. Groundnuts planting is done after tobacco and maize which results to low yields due to diseases and poor pod filling. Farm operations usually use manual labour for example groundnut production is labour intensive and additional labour is required especially for stripping, shelling and even grading. Problems faced by smallholder farmers include low productivity, dependence on rain-fed production systems with only one growing season, limited use of irrigation, limited access to market information, high transaction costs, and poor road, storage and market infrastructure (Muyanga, Nyirenda, Lifeyo, & J.Burke, 2020). Main threats for farmer workers in agriculture include exposure to pesticides, sharp tools, extreme temperatures and long working hours.

Unions for Maize and Groundnuts: Although organisation such as the National Smallholders' Association of Malawi and Farmers Union of Malawi has been established, most smallholder farmers and workers have not joined trade unions. Non-unionized smallholder farmers and workers are at risk of labour and employment abuses such as poor working conditions environments (poor housing, lack of protective wear, poor sanitation), unfair dismissals, nonpayment of wages and nonpayment or underpayment of severance pay.

Migrant workers: During peak cropping, Malawi experiences labour shortages influenced by seasonal demand fluctuations and persistent underemployment. Many migrant workers are employed seasonally on farms to provide essential labour for farm clearing, planting, cultivating and harvesting crops. The scarcity of economic opportunities together with the seasonality of rainfed agriculture results in labour shortages during critical cropping periods, alongside significant underemployment throughout the remainder of the year. These workers are exposed to several challenges, including poor working conditions, lack of healthcare and education for their families and vulnerability to exploitation by employers.

Migrants with regular status in Malawi can access public education, although this right is not explicitly guaranteed by legislation. Permanent residents in Malawi have unrestricted access to employment and self-employment opportunities, whereas migrants must apply for either a business residence permit or a temporary employment permit, both contingent on the specific job they intend to undertake and requiring proof of employment prior to issuance. Malawi lacks a dedicated policy or strategy aimed specifically at combating hate crimes, violence, xenophobia and discrimination against migrants. Migrants are protected under the Employment Act (2000) which prohibits discrimination in employment based on nationality while the Constitution prohibits discrimination based on national origin (IOM, 2022).

Occupational Health and safety: Agricultural workers in Malawi encounter distinctive occupational hazards related to their work such as exposure to pesticides, skin disorders, infectious diseases, heat related illnesses, respiratory issues and musculoskeletal injuries. Improper use of spraying pesticides by smallholder farmers may be directly linked to immune suppression, hormone disruption, reproductive abnormalities and cancer. In Malawi, studies indicate that pesticides self-poisoning accounts for approximately 80% of suicides. This method of poisoning, categorized as accidental or intentional (suicidal), also has significant public health implications (Soko, Agricultural Pesticide Use in Malawi, 2018).

### 5.4.2 Child Labour

Malawi has developed mechanisms including policies and legislations to safeguard and protect the rights and welfare of the children[20]. National Laws and regulation addressing child labour practices include the Constitution, the Employment Act (2000), the Child Care, Protection and Justice Act (2010) and the Education Act (2013), National Action Plan on Child Labour (2020-2025), among other laws. Child Care, Protection, and Justice Act (2010) specifically outlaws forced child labour. The law sets the minimum age for employment at 14 years of age, and children between the ages of 14 to 18 years old may not work in jobs that are considered hazardous or that interfere with their education. This provision is also outlined in the Employment Act 2000 and additionally prohibits children aged between 14 and 18 from engaging in hazardous work. The Education Act Mandates free and compulsory primary education up to age 18 years. Malawi has ratified Conventions on the Rights of the Child (CRC), the Worst Forms of Child Labor Convention, 1999 (No. 182) and the Minimum Age Convention, 1973 (No. 138).

Child labour is more prevalent in subsistence farms, tobacco and tea farms. Poor households tend to engage in child labour to supplement or substitute adult labour. Child labour in Malawi persists, impacting an estimated 2.1 million children aged 5 – 17 years (approximately 38% of the population). Child labour is prevalent in both rural and urban areas in Malawi, though its incidence is higher in rural settings. Specifically, 42% of children in rural areas are engaged in child labour, compared to 34% of children residing in cities and towns. Youth participation in the labour force in Malawi stands at 91%. Rate of underemployment is high among Malawian youths affecting over three-quarters (76%) of all Malawian youth, this issue is more prevalent in rural areas, affecting 75% of the youth compared to 60% in urban areas. Agricultural sector employs much of the rural youth with a 74% underemployment rate (ILO, 2018).

### 5.4.3 Forced Labour

National Laws such as the Constitution 1994 prohibits all forms of forced or compulsory labour and the Employment Act (2000) also prohibits and criminalises forced labour. Provisions for aspects related to trafficking of persons are stipulated in the 2015 Trafficking in Persons Act which criminalizes both trafficking of persons and children. Child trafficking is prohibited under the Child Care, Protection and Justice Act (2010). Malawi has ratified both the Abolition of Forced Labour Convention 1957 (No. 105), and the Forced Labour Convention 1930 (No. 29).

Forced labour is still a major problem although there is no evidence on use of forced labour in the maize and groundnuts production of Malawi **(ILO, 2023)**. Forced labour in Malawi is considered to be more prevalent in tobacco production it is possible that other agricultural crops such as groundnuts, and maize face similar hazardous that contribute to conditions of forced labour.

### 5.4.4 Access to Land and Land Tenure

The Land Act 2016 classifies land as either public or private. Public land is classified as either government land or unallocated customary land while private land is classified as freehold, leasehold or customary estate. Malawi has also enacted a Customary Land Act (CLA) in 2016 that enables smallholder farmers to convert their customary land rights to private land

[20] Refer to: Findings on the Worst Forms of Child Labor - Malawi | U.S. Department of Labor (dol.gov)

rights with registered title holding known as Customary Estates (CEs). The CEs are characterized by indefinite durations, inheritability and transmissible by will.

The agricultural sector in Malawi is predominantly composed of small-scale farmers who cultivate small rainfed plots primarily to grow food for local consumption. Ordinary Malawians residing on customary land often face challenges related to land grabbing arising from weak ad poorly defined land rights. Despite past land reforms in Malawi aimed at bolstering customary land rights, many individuals continue to experience instances of land grabbing. Although the CLA enhances individuals' land rights by introducing opportunities to apply customary estates, the act has inadvertently created a dual land system that potentially could secure land rights for wealthy Malawians while leaving the poor farmers vulnerable to insecure land rights (Yuh-Jin-Bae, 2021).

### 5.4.5 Community Health and safety

Agro-chemicals and fertilizers used in agricultural production can lead to contamination of underground water resources used by farmers. This water pollution poses significant health risks to communities reliant on wells and boreholes for drinking and cooking water. Improper handling or overuse of pesticides can lead to direct exposure among farmers and communities, potentially causing acute and chronic health problems. Wetlands offers many livelihood benefits to the communities and loss of these ecosystems could lead to significant community health and safety risks. Due to recurrent droughts, and declining soil fertility, there has been intensification of wetland cultivation in Malawi which has ed to significant losses to these wetlands.

## 5.5 GENERAL E&S RISK CONSIDERATIONS IN FL-RS INTERVENTION IMPLEMENTATION

The deployment of Food Loss Reduction Solutions (FL-RS) in Malawi must consider the specific environmental and social challenges outlined in the country profile to ensure the interventions are both effective and sustainable.

Land Degradation and Soil Erosion: The adoption of FL-RS technologies, such as hermetic storage and biological storage protectants, is expected to reduce the need for chemical pesticides, thereby mitigating soil acidification and degradation. Training on proper post-harvest techniques will also promote better land management practices, potentially decreasing the expansion of agriculture into ecologically sensitive areas, which exacerbates land degradation.

Soil Fertility and Acidification: FL-RS interventions, particularly those that reduce post-harvest losses, could help alleviate pressure on the soil by reducing the need to cultivate additional land.

Labour Conditions: The introduction of mechanical threshers and shellers will likely reduce the physical burden on smallholder farmers, particularly in the labour-intensive cultivation of groundnuts. This could improve working conditions by decreasing the need for manual labour during peak agricultural seasons.

Child and Forced Labour: FL-RS interventions that increase productivity and efficiency could reduce the economic pressures that lead to child labour in the agricultural sector. By improving yields and reducing losses, families may rely less on child labour to meet production needs. Similarly, increased financial access to machinery and the formation of farmer cooperatives could provide economic alternatives that diminish the prevalence of forced labour.

Access to Land and Land Tenure: The deployment of FL-RS technologies must be sensitive to existing land tenure issues. The introduction of new technologies and practices should be accompanied by efforts to secure land rights for smallholder farmers, particularly those on customary lands.

# 6 Tanzania

## INTRODUCTION

**Agriculture is the backbone of Tanzania's economy, contributing significantly to GDP, employment, and trade. Despite positive growth, the sector faces challenges, such as underdeveloped infrastructure and reliance on traditional farming methods, which limit efforts to reduce poverty.** Smallholder farmers dominate agricultural production, focusing on food crops like maize and rice that are essential for food security. However, large-scale farming remains underutilized, presenting opportunities for growth (Ministery of Agriculture in Tansania, 2013).

**To address these challenges, Tanzania's agricultural policy framework is designed to enhance the sector's efficiency, competitiveness, and sustainability, with a focus on improving livelihoods and reducing poverty** (see section 5.2). Key strategies include the National Agricultural Policy, which aims to strengthen technical services, food security, and land use; the National Water Policy for sustainable resource management; and the Agricultural Sector Development Programme to boost productivity and private investment. The framework also includes the National Post-harvest Management Strategy to reduce food losses and the National Climate Change Strategy for adaptation and emission reduction. Supporting legislation, such as the Constitution of Tanzania, the Plant Health Act, and the Fertilizer Act, alongside regulatory bodies like the Ministry of Agriculture, the National Irrigation Commission, and the Tanzania Agricultural Research Institute, ensures these goals are pursued. Together, these policies aim to create a robust, sustainable agricultural sector that supports economic growth and environmental resilience.

**Tanzania faces significant environmental challenges, particularly regarding water scarcity, land degradation, soil fertility, pesticide use, deforestation, and the adoption of genetically modified (GM) crops.** Water scarcity, exacerbated by climate change, leads to reduced crop yields due to unpredictable rainfall and increased temperatures, threatening the agricultural sector, which relies heavily on rain-fed farming. Land degradation and soil erosion affect over half of Tanzania's land, severely impacting crop productivity for staples like maize and rice (Rowhani, Lobell, Linderman, & Ramankutty, 2011). Soil fertility decline and acidification further compromise food security, affecting 80% of the population dependent on agriculture (IFDC, 2018). Pesticide misuse is prevalent, with hazardous chemicals banned elsewhere still in use, posing significant health and environmental risks. Meanwhile, deforestation driven by small-scale agriculture and other activities leads to an annual loss of 400,000 hectares of forest, further threatening environmental stability.

**The agricultural sector also faces significant social risks, primarily affecting smallholder farmers who struggle with limited access to modern technologies and proper pesticide management, which pose health risks.** Many farmers are not part of unions, limiting their access to markets and credit, while migrant workers often endure poor working conditions and lack labour protections. Child labour remains prevalent, particularly in agriculture, affecting approximately 4.2 million children engaged in hazardous tasks without proper regulations or enforcement (ILO, 2018). Land tenure issues, characterized by conflicts between farmers and pastoralists due to ambiguous land rights and corruption in land administration, further compound these challenges. Community health and safety are jeopardized by land degradation, unsustainable farming practices, deforestation, and improper pesticide use, all of which undermine food security and economic stability.

# LIST OF ACRONYMS

| | |
|---|---|
| ASA | Agricultural Seed Agency |
| CSA | Climate Smart Agriculture Guideline |
| GDP | Gross Domestic Product |
| GM | genetically modified |
| MoA | Ministry of Agriculture |
| NAP | National Agriculture Plan |
| NBMA | National Biosafety Management Authority |
| NDC | Nationally Determined Contribution |
| NFRA | National Food Reserve Agency |
| NIRC | National Irrigation Commission |
| NPHMS | National Post-harvest Management Strategy |
| NRDS | National Rice Development Strategy |
| TARI | Tanzania Agricultural Research Institute |
| TDV | Tanzania Development Vision |
| TFRA | Tanzania Fertilizer Regulatory Authority |
| TPHPA | Tanzania Plant Health and Pesticides Authority |

## 6.1 PILLARS OF TANZANIA'S AGRICULTURAL SECTOR: FOCUS ON MAIZE AND RICE

### 6.1.1 The Agricultural Economic Landscape

Market overview

Agriculture is the backbone of the Tanzanian economy, making up almost 31% of the GDP and 25% of annual trade profits, while employing about 68% of the workforce (FAO, 2018). The growth rate in agriculture is higher than the average annual population growth rate of 2.6%, which suggests incomes are growing. However, the average agricultural growth rate of 4.4% is not enough to create significant wealth and reduce poverty, due to the low level of rural development. In 2012, crop production contributed around 17.6% to the GDP, while livestock production added about 4.6% to the GDP. These numbers show how important both crop and livestock production are to Tanzania's economy.

To achieve higher growth rates in agriculture, there needs to be an improvement in rural infrastructure, better access to modern farming techniques, and investment in sustainable practices. These steps will not only increase productivity but also ensure that the benefits of growth are widely shared, leading to significant poverty reduction and economic progress in Tanzania (Ministery of Agriculture in Tansania, 2013).

Dominant farming practices

In general, food crops account for about 65% of agricultural GDP and cash crops account for about 10%. Maize is the most important crop accounting for over 20% of agricultural GDP. Food and cash crops account for about 70% of rural income. In formulating the National Agriculture Plan (NAP) 2013, a holistic approach was taken to move from the concept of food and cash crops to agricultural crops that encompass both concepts. This is because some food crops are also used to earn money, so there is no demarcation as to whether these are food crops or not.

- **Small-scale farming:** Smallholder farmers form the backbone of Tanzanian agriculture. They cultivate approximately 5.1 million hectares annually, with 85% dedicated to food crops. They contribute over 75% of total agricultural outputs in Tanzania, primarily producing for home consumption using traditional methods. Common staple crops grown by smallholder families include maize, beans, cassava, sweet potatoes, and rice (TanzaniaInvest, 2024).
- **Large-scale farming:** Tanzania has between 1,000 to 2,000 large-scale farms, each averaging 1,100 hectares in size. However, this sector is currently underutilized despite the country having a vast 29 million hectares of irrigable land (Madenge, 2024). Large-scale farms grow a variety of crops, including sugarcane, rice, wheat, coffee, tea, sunflower, pulses, flowers, cotton, sisal, grapes, sesame, and maize

The importance of agriculture to Tanzania's economy is clear. Food crops, particularly maize, play a crucial role in sustaining the GDP and providing rural income. Smallholder farmers are vital, producing the majority of the country's agricultural output with limited resources and traditional methods. Meanwhile, the potential for large-scale farming remains largely untapped, offering a significant opportunity for growth and development. To maximize agricultural growth and reduce poverty, it is essential to invest in rural infrastructure, modernize farming techniques, and promote sustainable practices. This will not only increase productivity but also ensure that the benefits of agricultural growth are widely shared, leading to significant poverty reduction and economic progress in Tanzania.

Internal-Export dynamics

The agriculture market in Tanzania is estimated to be 16.54 billion US$ in 2024 and is expected to reach 20.64 billion US$ by 2029 (Mordor Intelligence, 2024).

**Exports:**

- Cashew Nuts: Cashew nuts are a major export, contributing roughly 341 million US$.
- Horticultural Items: The export of horticultural items generates around 260 million US$.
- Other significant agrarian exports include tobacco, coffee, fish, cotton, tea, sisal, and cloves.

Tanzania's main export partners are India, Japan, China, United Arab Emirates, Netherlands, and Germany (The Exchange , 2024).

**Imports:** While the focus is on exports, it's essential to note that Tanzania also imports certain agricultural products. For instance, wheat imports are expected to remain at 1.1 million metric tons due to low domestic production and increasing local consumption. Tanzania imports wheat from countries like Russia, Australia, Canada, the EU, and Ukraine (ITA, 2022).

### 6.1.2 Maize Crop overview

Tanzania has been among the top 25 maize producing countries in the world for the past two decades, Maize is the most commonly grown and consumed food in Tanzania as it accounts for more than 70% of the country's cereal production **(SME Impact Fund, 2024)**. Maize is Tanzania's most important cereal crop in terms of food security, accounting for 63% of the country's food crop production **(TanzaniaInvest, 2024)**. It is known to be used to make solid porridge (ugali), a national dish in Tanzania and most African countries.

Source : Jihabarishe, 2024

*Figure 6-1 Maize harvest*

Market analysis: Tanzania produced 8.1 million tonnes of maize last year, surpassing the local demand of 6 million tonnes. This surplus of 2.1 million tonnes positions Tanzania well for export markets (The East African , 2024). Kenya is the primary

destination for Tanzanian maize exports, receiving approximately 70% of the total value of maize exported in 2020 (Cowling, Importing markets for maize exported by Tanzania in 2020, 2024).

Tanzanian authorities are urging maize farmers to find markets for their surplus in neighbouring countries. According to the Ministry of Agriculture, the country is expecting a bumper harvest, which will exceed the provisional forecast of maize demand for export markets in neighbouring countries, estimated at more than 1.2 million tonnes. With record maize harvests expected in the country's main growing areas in the south, the National Food Reserve Agency will purchase grains from farmers in early July 2024. NFRA's strategy is to manage food reserves to ensure a sustainable supply that meets both domestic and export needs, the agency official said (The East African , 2024).

*Table 6-1 Revised maize market information*

| | Consumption (MT) | Imports (MT) | Exports (MT) | Seed (MT) | Production (MT) |
|---|---|---|---|---|---|
| 2001 | 4 755 472 | 31 045 | 25 579 | 34 000 | 4 784 006 |
| 2002 | 4 863 412 | 63 373 | 152 310 | 69 000 | 5 021 349 |
| 2003 | 4 985 629 | 77 991 | 156 193 | 63 000 | 5 126 831 |
| 2004 | 5 099 543 | 128 374 | 53 747 | 62 000 | 5 086 916 |
| 2005 | 5 249 170 | 18 901 | 101 394 | 60 000 | 5 391 663 |
| 2006 | 5 465 791 | 252 632 | 23 507 | 62 000 | 5 298 666 |
| 2007 | 5 649 835 | 6 609 | 87 076 | 62 000 | 5 792 302 |
| 2008 | 5 816 739 | 20 468 | 93 834 | 59 226 | 5 949 330 |
| 2009 | 5 974 396 | 6 415 | 100 592 | 62 000 | 6 130 572 |
| 2010 | 6 145 037 | 18 588 | 107 349 | 69 605 | 6 303 403 |
| 2011 | 6 418 248 | 11 931 | 114 107 | 73 827 | 6 594 251 |

Source: FAO, 2015

There are four recognized market channels:

- A myriad of small-scale farmers who sell to local traders and millers mainly in the rural areas and nearby cities.
- Medium-sized grain traders and millers who serve rural and urban centres;
    - A few well-established, large-scale millers and traders based in Dar es Salaam, operating in both national and export markets; and
- Institutional buyers including The National Food Reserve Agency (NFRA), the World Food Programme (WFP), prisons, the armed forces, hospitals and schools (R. Trevor Wilson, J. Lewis, 2015).

Dominant farming practices and value chain: Maize is the staple food for the majority of Tanzanians. The majority of maize (80%) is produced by smallholder farmers, both for home consumption and as a cash crop. 65-80 % of all maize is consumed by the producing household, while only 20-35% is distributed into commercial channels. With large regional variations, maize accounts for an average of 16% of national household food expenditures. Maize is typically grown under low-input, rain-fed conditions. The decision to grow maize even in areas with insufficient rainfall is due to a strong preference for maize over drought-adapted traditional cereals such as sorghum and millet. Efforts are underway to develop more drought-tolerant varieties and increase irrigation options for Tanzanian farmers.

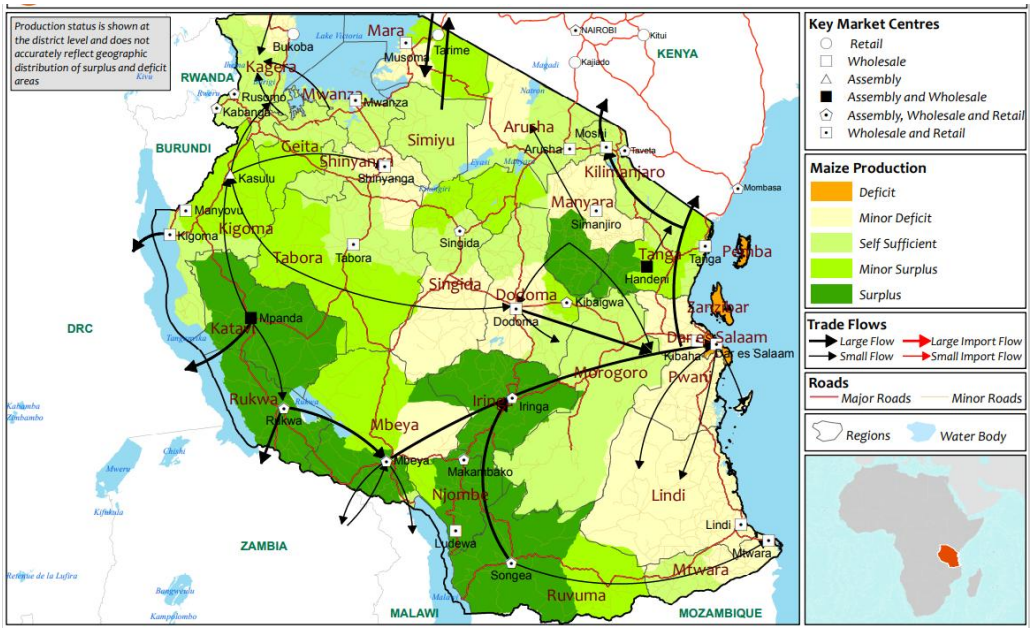
Despite the importance of maize to Tanzania and Tanzanians, the value chain is fragmented and poorly linked. There are many layers and inefficient connections between producers and consumers. Credibility, reliable information systems, and the benefits of economies of scale are not well established. Most commercial maize is delivered to local collection points and collected by traders who resell in local, regional and urban markets. Some is sold to processors and grain traders who collect and export it. This benefits large-scale farmers in the sector but harms small farmers.

There are a limited number of large roller mills producing quality flour products, all of which are operating well below capacity.

Small hammer mills are primarily used throughout Tanzania to process grain into a cheaper, lower quality flour. However, their economic viability is uncertain and, if profits are available, they are based on bulk trading with no real traceability of the product. Several general issues affect the maize value chain and raise concerns for agricultural growth more generally. These include land tenure, land management and land use planning; local production taxes ("levies"); corruption; a difficult business environment; inadequate rural infrastructure; high transport costs; difficulty accessing affordable financing; limited trade opportunities and periodic export bans. There are also several key issues specific to maize, such as availability of suitable varieties; seed availability; management of soil nutrients and soil moisture; maize markets and market information; and processing capacity and efficiency (R. Trevor Wilson, J. Lewis, 2015).

Regional focus areas:

All 21 regions of Tanzania produce maize, albeit about 505 is produced in the Southern Highland regions of Morogoro, lunga, Mbeya, Rukwa and Ruvuma (figure 2). It is usually grown under low input, rainfed conditions (Milling : Middle East & Africa , 2022).




Source: USAID, 2018

**Figure 6-2 Maize production and trade flow map**

## 6.1.3 Rice Crop overview

Tanzania stands as the largest rice producer in the East African region. The rice sub-sector has long been recognized by the Tanzanian government as a strategic priority for agricultural development due to its significant potential to enhance food security and boost income for rural households **(ITA, 2024)**. Rice (Oryza sativa) holds the position of the second most important food crop in Tanzania, following maize.

Rice is vital to Tanzania's food security and economy. The consumption of rice in the country has been increasing rapidly, with the average consumption exceeding 25 kg per person per year. This figure is even higher in urban areas, where dietary preferences and economic factors drive greater demand.

Source: Daily News, 2022

***Figure 6-3 Rice producers***

Market analysis: Rice consumption in Tanzania has increased sharply from 94,000 tonnes of milled rice in the 1960s to 1,800,000 tonnes in the 2010s (USDA, 2024). Tanzania's domestic supply in 2013 totalled approximately 1.2 million tonnes of 4,444 kernels of milled rice, making the country the seventh-largest rice producer among African countries. Tanzania's population has grown steadily since the 1950s, with rural populations migrating to major cities such as Dar es Salaam and Arusha in the 1970s. As a result, per capita consumption, estimated by dividing domestic consumption by total population, has also increased sharply since the 1990s. In response to increasing demand for rice, rice production in Tanzania increased between the 1960s and the 2010s. This increase has been achieved primarily through an expansion of the area under cultivation rather than an increase in yield.

Although the area under rice cultivation has increased nine-fold from 100,000 hectares in the 1960s to 960,000 hectares in the past decade (2007–2016), average rice yields have only increased 1.8-fold, from 1.2 tons/ha to 2.2 tons/ha. This small increase in rice yields contrasts with the more rapid increase in East, South and Southeast Asian countries over the same period, from 2.1 to 4.8 tons/ha (Araki, 2020). With the rapid increase in population, Tanzania's economy relies on imports to reply to the excessive demand. In 2022, Tanzania imported 80 million US$ worth of rice, becoming the 80th largest importer of Rice in the world. Tanzania imports Rice primarily from: Pakistan (48M US$), India (21M US$), Vietnam (8.93M US$), Thailand (1.34M US$), and Malawi (75k US$) (OEC, 2024).

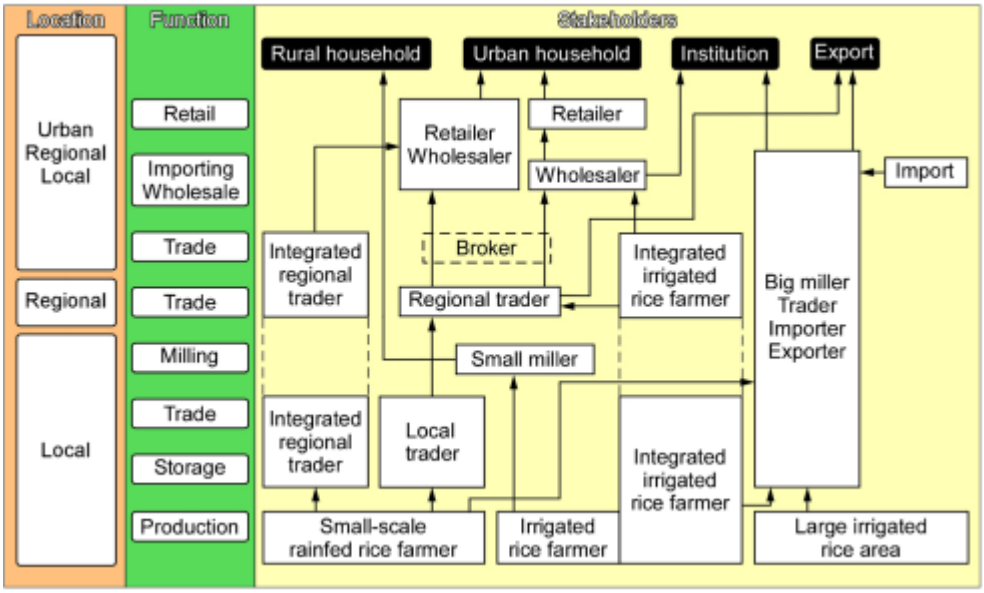
Dominant farming practices and value chain: Tanzania produces rice in two main ecosystems: irrigated lowlands and rain-fed lowlands. Currently, most rice is produced in the rain-fed lowlands, but the country's National Rice Development Strategy (NRDS) hoped to reverse this trend by 2018 (Joseph Mkanthama, 2017).

- **Rainfed Lowland Practices:** Farmers often use random sowing for this type of cultivation. However, newer sowing techniques such as grid patterns are more and more prominent among farmers (BBC, 2013).
- **Irrigated Rice Practices:** Farmers often use direct seeding or transplanting methods. This rice farming occurs in areas with controlled water supply; as Tanzania has about 3,000 irrigation systems covering a total area of 270,000 hectares, of which rice is cultivated in 461 systems covering an area of about 100,000 hectares. Water is obtained from permanent rivers, seasonal water bodies, dams, or groundwater. Irrigation systems such as in the Kilimanjaro region use modern irrigation facilities and permanent water sources to grow rice crops two and sometimes three

times a year. However, in the case of the Lower Moshi Irrigation Scheme (LMIS), the high productivity of irrigated rice has led to an expansion of the irrigated area and intensification of cultivation up stream, resulting in water scarcity for the system itself. In irrigation systems that rely on seasonal water, such as in Morogoro, Mbeya, and Rukwa regions, rice crops are often grown rain-fed in years with low rainfall (Araki, 2020).

Traditional small-scale rain-fed production, which includes flooded lowlands and upland cropping in highlands, is the dominant system, covering about 74% of Tanzania's rice-producing area. This method relies on minimal technology, with farmers typically using stored seeds for planting and applying little to no fertilizer. Storage using warehouse receipt systems (WRS) is limited, and local markets usually operate with spot prices. Improved small-scale rain-fed production, which accounts for about 20% of the cultivated area, incorporates modern techniques. This system uses new seed varieties, hand-planted rows, and irrigation. It also involves higher fertilizer use and better storage and trading practices through WRS.

Large-scale integrated production on commercial farms constitutes 6% of Tanzania's rice-producing area. These farms benefit from investment capital and are engaged in various supply chain activities. They provide inputs and services to outgrowers, and handle storage, processing, and distribution to urban wholesaler (R. Trevor Wilson, I Lewis, 2015). Rice is distributed nationwide in Tanzania. Major cities for travel retail, wholesale, assembly and trade are shown in Figure below.



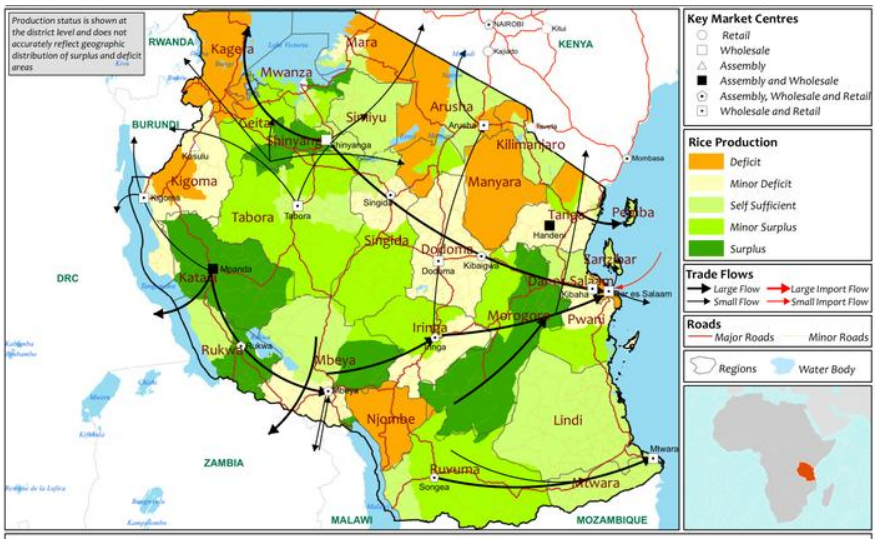

Source: Araki, 2020

*Figure 6-4 Rice value chain*

Regional focus areas: Rice cultivation has spread across Tanzania as environmental conditions have provided rice farmers with a great opportunity to develop their own agro-ecosystems. The Mwanza, Shinyanga, and Tabora regions in the northwest are occupied by savannah grasslands. Typically, these three regions receive limited annual rainfall of 500-800mm, so farmers cultivate rice in the rain-fed lowlands on gentle slopes using water harvesting techniques.

In the northeastern Kilimanjaro region, large-scale irrigation systems established by national and international agencies have enabled high rice yields. In that region rice can be grown two to three times a year if water is available all year round. The Morogoro region has numerous irrigation systems of various sizes. The relatively high annual rainfall of 1,000-2,000 mm results in high rice yields, even in rain-fed fields. Highland rice is also cultivated in the mountainous areas. The southern Mbeya and Rukwa regions also have irrigation systems of various sizes, with water provided by numerous rivers and streams.

Rain-fed fields have ample rainfall, ranging from 800 to 2800 mm per year, and produce relatively high rice yields. Rice from both regions commands a high price in the domestic market due to its good taste and aroma. Coastal regions such as Tanga, Pwani, Lindi, Mtwara and Zanzibar are also known for rice cultivation. Many small rain-fed fields are in inland valleys, where rice production depends mainly on runoff from the hillsides (Araki, 2020).




Source: USAID, 2018

*Figure 6-5 Rice Production and Trade map*

### 6.1.4 Post-Harvest Food Loss Analysis – Maize and Rice

In Tanzania, maize faces significant food losses, with drying and harvesting causing a 6.40% loss. Additional drying contributes to a 4% loss, shelling and threshing add 1.30%, and household storage results in a 5.20% loss. Transport from the field incurs a 2.40% loss, as recorded by APHILIS.

Rice losses are also notable, with drying and harvesting causing a 4.40% loss, shelling and threshing contributing to a 3.10% loss, household storage adding a 1% loss, and transportation from the field leading to a 1.30% loss, according to APHILIS.

## 6.2 E&S POLICY FRAMEWORK

### 6.2.1 Agricultural National Strategies

National Agricultural Policy (2013): The general objective of the is to develop an efficient, competitive and profitable agricultural industry that contributes to the improvement of the livelihoods of Tanzanians and attainment of broad-based economic growth and poverty alleviation. Specific objectives include strengthen agricultural support and technical services, enhancing national food and nutrition security, protecting and promoting integrated and sustainable utilization of agricultural lands. The NAP is a result of macro, regional and global economic changes that have bearing on the development of the agricultural sector. NAP also provides key policy areas for cross-cutting issues such as environment, gender, HIV/AIDS, Malaria and water borne diseases, employment and decent work in agriculture.

National Water Policy (2002): The policy develops a comprehensive framework for sustainable development and management of Tanzania's water resources for the benefit of all based on a clear set of guiding principles. The policy proposes the implementation of an integrated water resource management approach which minimizes the effects of externalities, and ensures sustainability and protection of the resource

Agriculture Marketing Policy (2008): The overall objective of the Agricultural Marketing Policy is to establish competitive, efficient and equitable agricultural marketing system, including sectors such as crop production, animal husbandry, fishery, and forestry.

Agricultural Sector Development Programme Phase Two (ASDP II): This programme is used to help Tanzania to meet the Tanzania Development Vision TDV 2025 vision. Launched in 2006 to provide sector-wide investment intervention, it had contributed poverty reduction from 27% to 14% by 2010. The objectives of the plan are to enable farmers to have better access to, and use of, agricultural knowledge, technologies, marketing systems and infrastructure, all of which contribute to higher productivity, profitability, and farm incomes; and promote private investment based on an improved regulatory and policy environment.

National Post-harvest Management Strategy (NPHMS) 2019 – 2029: It is a 10-year strategy with provisions if interventions on how to reduce post-harvest losses along commodity value chain. The NPHMS focuses on food crops particularly cereals, legumes, fruits and vegetables, roots and tubers and edible oil crops. The NPHMS aims at facilitating and building capacity of postharvest actors to reduce losses and increase their income, food and nutrition security. This strategy intends to facilitate the achievement of the African Union Malabo Commitment by halving post-harvest losses by 2025 and the United Nations General Assembly Sustainable Development Goal 12.3 which aims to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains by 2030.

National Climate Change Strategy (URT, 2012): The strategy sets out strategic interventions for climate change adaptation measures and greenhouse gas emission reductions. It presents a wide range of adaptation options including, but not limited to: improving agricultural land and water management, accelerating uptake of CSA, reducing impacts of climate-related shocks through risk management, and strengthening knowledge and systems to targeted climate action.

Climate-Smart Agriculture Programme for Tanzania (2015 – 2025): The programme has the Vision to have an "Agricultural sector that sustainably increases productivity, enhances climate resilience and food security for the national economic development''. The programme aims to build resilience of agricultural farming systems for enhanced food and nutrition security through six programmatic result areas namely: Improved productivity and incomes; building resilience and associated

mitigation co-benefits; value chain integration; research for development and innovations; improving and sustaining agricultural advisory services; and improved institutional coordination.

Climate Smart Agriculture Guideline (CSA) (May 2017): The CSA guidelines development is a step towards achieving global and national goals of sustainable agriculture production in a changing climate. The guideline has adopted this definition for climate smart agriculture: agriculture that sustainably increases ability to adapt and build resilience to climate change and enhances food and nutrition security while achieving co-benefits in line with national development priorities (National Task Force Workshop Report, 2016). This Guideline is based on an inclusive multi-level approach gender-responsive approach, community-based approach, farmer-centered research, learning, and training approach. The guide describes and helps users to understand CSA technologies and practices.

National Rice Development Strategy Phase II (NRDS II) 2019 – 2030: This strategy envisions to sustain national self-sufficiency in rice production, contribute to the regional self-sufficiency, and become a market leader in the region. NRDS II aims to implement a value chain approach to achieving it mid-tern (2025) and long term (2030) targets. Through intervention elements (policy tools, research and development, extension services, institutional coordination, and gender equity), the NRDS II addresses the various rice value chain segments (seeds, fertilizer, irrigation, mechanization, postharvest handling, processing and marketing).

### 6.2.2 Key Legislation

Constitution of the United Republic of Tanzania, 1977: Also known as Permanent Constitution. It was ratified in 1977. It is the overarching law that outlines fundamental principles and rights. Right to property and security of tenure is governed by Article 24 of the constitution which affirms the right of every person to own property and protection of property held in accordance with the law. In addition, Article 27(1) prescribes that every person has the duty to protect the natural resources of the United Republic, the property of the state authority, all property collectively owned by the people, and also to respect another person's property. (2) All persons shall be required by law to safeguard the property of the state authority and all property collectively owned by the people, to combat all forms of waste and squander, and to manage the national economy assiduously with the attitude of people who are masters of the destiny of their nation. The Constitution of Tanzania does not include provisions to right to food and water

Tanzania Development Vision (TDV) 2025: It is a long-term vision that the Government of Tanzania issued to guide its development. TDV vision is that by 2025 Tanzanians will have created a substantially developed, people centred, peaceful, stable and united society with high quality livelihood and high level of human development. The agriculture sector is identified as an important arena where strategic interventions will be implemented to contribute to the building of a strong solid foundation for a highly productive, competitive and dynamic economy.

Crops Laws (Miscellaneous Amendments) Act, 2009 (No. 20 of 2009): This is an Act that amends various crop laws with an aim of rationalizing roles and functions of Crop Boards, their financing and to provide for other related matters. This Act amends various Acts relative to manufacturing and placing on the market of various crops in relation with Boards established under such legislation.

Plant Health Act No. 4 of 2020: An Act of parliament with provisions for control of pesticides, phytosanitary measures, importation and use of plants and plant products, prevention of introduction and spread of pests, establishment of the Tanzania Plant Health and Pesticides Authority and for related matters. Articles 14 and 15 of the Act prohibits the use of

unregistered pesticides and mandates dealers who formulate, sell or manufacture pesticides to ensure their registration to enable the authority to conduct a bio-efficacy trial and analysis of the said pesticide.

Fertilizer Act Cap 378 (2009): This act provides regulation on utilization of agricultural and prohibit the use of fertilizers in a manner that it has adverse impacts on the environment. The Act makes provisions for regulation of manufacturing, importation, exportation, sale and utilization of agricultural fertilizers. This Act establishes the Tanzania Fertilizer Regulatory Authority as a regulatory body to deal with fertilizer related matters in Tanzania.

Seeds Act, 2003: It is an act of parliament that controls and regulates the standards of agricultural seeds in Tanzania. The National Seeds Committee, a technical committee established under section 3, is responsible for advising the Government on all matters relating to the development of the Tanzania seed industry. The act specifies the conditions for dealing with seeds related to importation, exportation, production, processing, distribution, sale, and advertisement. It also highlights registration of seeds dealers, issuance of certificates of registration, cancellation of certificates, appeals, and other related matters.

National Irrigation Act, 2013: The Act guides the development, operation and maintenance of irrigation and drainage systems. It establishes the National Irrigation Commission as a corporate body and defines its powers and functions. The National Irrigation Commission oversees the implementation of the National Irrigation Policy, Strategy, National Irrigation Master Plan and related legislation.

Land Act No. 4 of 1999: The Act governs the administration of land and land tenure in Tanzania. The Act establishes three categories of land: general land, village land and reserved land. For reserved land, the Section 6 of the Act defines it as land being covered by forests, national parks, conservation areas, wildlife conservation, marine parks, urban planning, roads, public recreation ground and land acquisition legislations. This Act is supported by the Village Land Act No. 5 of 1999: This Act makes provisions for management and administration of land in villages and other related matters.

Land Use Planning Act No. 6 of 2007: The act makes provides procedures for preparation, administration and enforcement of land use plans. It provides the fundamental principles of land use planning and establishment of the land use planning authorities including a village council, district council and National Land Use Planning Commission.

Updated Nationally Determined Contribution (NDC) July 2021: In the updated, Tanzania has committed to reducing greenhouse gases (GHG) economy-wide by 30 -35% compared to the Business-As-Usual (BAU) scenario by 2030. Tanzania's per capita emission was estimated at 0.22 tCO2e in 2014, which is markedly lower than the global average of 7.58 tCO2e recorded the same year. Adaptation measures will be implemented across various sectors including agriculture, livestock, forestry, energy, water, sanitation and hygiene, tourism, land use and human settlements development, health, infrastructure, among others. The Updated NDC aims to overcome challenges such as weak institutional and financial frameworks, limited access to appropriate technologies, deficient climate knowledge management, insufficient stakeholder participation, and low public awareness to successfully implement adaptation and mitigation strategies. The implementation of the Updated NDC is affected by continual effects of climate change variabilities, with extreme events like droughts and floods that impose significant economic costs, hinder long-term growth and disrupt the livelihoods of both rural and urban communities.

### 6.2.3 Regulatory Bodies

Ministry of Agriculture (MoA)[21]: It was founded in 2017 after the split of the Ministry Agriculture, Livestock and Fisheries. The ministry's mission is to deliver quality agricultural and cooperative services, provide conducive environment to stakeholders, build capacity of local Government Authorities and facilitate the private sector to contribute effectively to sustainable agricultural production, productivity and cooperative development. The specific objectives delegated to MoA include:

- Formulating, coordinating, monitoring and evaluating the implementation of relevant policies in the agricultural sector and monitoring crop regulating institution;
- Collaboration with the private sector, local government and other service providers to provide relevant technical service in research, extension, irrigation, plant protection, crop promotion, land use, mechanization, agricultural inputs, information services and cooperative development;
- Undertaking crop monitoring and early warning, maintaining strategic food reserves and promoting appropriate post harvest technologies, and
- Encouraging, undertaking and coordinating research and development and training.

The MoA is subdivided into the following division and units: Crop Development Division, National Food Security Division, Agricultural Training, Extension Services And Research Division, Agricultural Land Use Planning And Management Division, Agricultural Mechanisation and Irrigation Division, Administration And Human Resources Management Division, Internal Audit Unit, Policy And Planning Division, Government Communication Unit (GCU), Procurement Management Unit, Environmental Management Unit, Finance And Accounts Unit, Nformation And Communication Technology Unit, Legal Services Unit and Plant Breeder's Rights Unit

National Irrigation Commission (NIRC): It is an independent department of the government responsible for irrigation. NiRC has the mandate to coordinate, promote and regulate function in the development of irrigation sector. NiRC main responsibilities include, amongst others, Advise the Minister on declaration of irrigation areas, Register and maintain a register of all Irrigators implement and review irrigation related legislation, promote institutional linkages training programmes and support the recruitment of persons for purposes of employment in connection with the irrigation sector and Advise the government in all matters relating to development and management of irrigation sector in the country.

Agricultural Seed Agency (ASA): ASA is responsible for providing high quality seeds to farmers at an affordable proce. The key functions of the agency are:

- Expanding seed production and distribution networks thus facilitating seed accessibility by farmers;
- Promoting increased private sector participation in the seed industry development through establishment of public-private partnerships or joint ventures in seed production and distribution;
- Promoting increased demand of certified seed by farmers; and
- Strengthening research capacities for breeding and producing varieties that address farmers' specific demands.

Tanzania Agricultural Research Institute (TARI): Statutory body established under the Tanzania Agricultural Research Institute Act, 2016 (No. 10 of 2016). The act establishes TARI as a body corporate and provides with respect to its functions, powers,

[21] Refer to: Ministry of Agriculture (kilimo.go.tz)

administration, etc. The Institute is responsible for conducting, regulating and coordinating all agricultural research activities in the Mainland Tanzania. The agricultural research themes, including, among other things: land use and water management, agroforestry, environmental management and climate change resilience, biotechnology. TARI is aimed at strengthening national agricultural research system to enhance development and dissemination of technologies, innovations and management practices and address the challenges of farmers and other agricultural stakeholders.

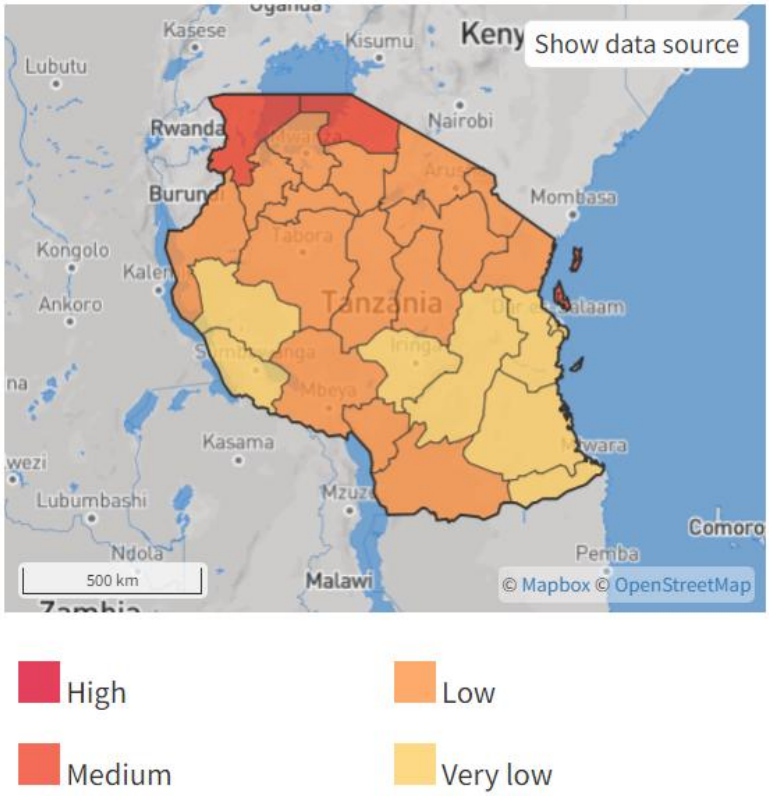
Tanzania Plant Health and Pesticides Authority (TPHPA): It is a corporate body established by the Plant Health Act No. 4 of 2020 (Article 4) with the overall responsibility of plan health within the country. The specific objectives of the authority are: to issue certificates relating to the phytosanitary measures; to perform the surveillance of growing plants both in domestic and wild flora and of plants and plant products in transportation with the object of reporting the outbreak and spread of pests and of controlling such pests; to disinfect or disinfests consignments of plants and plant products moving in international traffic to meet phytosanitary requirements; to protect endangered areas, to conduct pest risk analysis, register pesticides and bio-pesticides, among others.

Tanzania Fertilizer Regulatory Authority (TFRA): It is a regulatory body established by the Fertilizers Act, 2009 (No. 9 of 2009). TFRA enforces the regulations related to the manufacturing, importation and use of and trade in fertilizers, or fertilizer supplements. It also provides for fertilizer quality control and requires fertilizer dealers to ensure that fertilizer or fertilizer supplements are packed and labelled in the manner prescribed in the regulations.

## 6.3 ENVIRONMENTAL RISKS ANALYSIS

### 6.3.1 Water availability

Water scarcity is becoming an increasing problem, with water levels dropping dramatically in many major water bodies, including Lake Victoria, Lake Tanganyika, Lake Jipe and Lake Rukwa. Agriculture in Tanzania, where more than half the population is employed, is particularly at risk as the majority of farmers rely on rain-fed agriculture. Meanwhile, increased intensity of rainfall has caused flooding across the region, destroying infrastructure and livelihoods (UNDP, 2024).
According to Thinkhazard, water scarcity is classified as medium according to the information that is currently available to this tool. This means that there is up to 20% chance droughts will occur in the coming 10 years.




*Source: ThinkHasard!*

*Figure 6-6 Water availability*

Agriculture is considered to be the sector most vulnerable to climate change in Tanzania. A 2°C to 4°C increase in temperature is likely to alter the distribution of Tanzania's seven agro-ecological zones. Areas previously cultivated with perennial plants would become more suitable for the cultivation of annual plants. Climate change will accelerate plant growth and shorten the length of the growing season.

Vulnerability in the agricultural sector is likely to include reduced yields for a range of crops, exacerbated by climate variability and seasonal unpredictability, erosion of the natural resource base, and environmental degradation (UNEP, 2007). A 2011 study found that crop yields are affected by both warming and increased variability. A 2°C increase in temperature during the growing season, as projected by 2050, could reduce rice, sorghum and maize yields in Tanzania by 7.6%, 8.8% and 13%, respectively. A 20% increase in intraseasonal rainfall variability could reduce rice, sorghum and maize yields by 7.6%, 7.2%

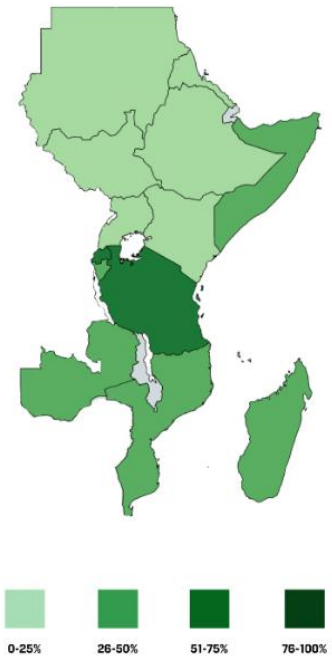
and 4.2%, respectively, by 2050. For example, severe droughts in Dodoma caused crop yields to fall by 80% (Rowhani, Lobell, Linderman, & Ramankutty, 2011).

### 6.3.2 Land Degradation and Soil Erosion

Tanzania is severely affected by land erosion, as 51% of its land is soil erosion hotspots. Much of the increase in land degradation in Tanzania has happened in the last 70 years as farming techniques and trends have evolved in ways that have proved harmful to the land, largely due to the villagization of Tanzania.

Land degradation severely affects soil functions, thereby weakening crop productivity. Soil erosion reduces soil physicochemical properties, leads to a decline in microbial abundance, and causes changes in soil organic matter composition, which directly translates into reduced crop yields (Ming Gao, 2024). According to the same study, maize is one of the crops that are highly affected by land degradation, as yields are significantly linked to soil quality. Rice also takes a place among crops that are highly sensitive to soil quality as it is directly linked to its yield production. Especially in terms of the soil's bacterial community (Lu Zhang, 2021).

Farmers need arable land to cultivate their fields. Soil erosion makes farming more difficult and leads to poor crop yields. For this reason, farmers in Tanzania are the group most affected by soil erosion. About half of the country's area is affected by long-term soil erosion, meaning farmers can no longer meet their needs. In rural areas, it is common for people to farm only for their own consumption and not harvest crops to sell for a profit. As a result, there is less local food available for consumption in urban areas, highlighting how food insecurity due to soil erosion is affecting both urban and rural populations in Tanzania (Nora Ririe, 2022).




Source: Ballard Breif

*Figure 6-7 Percentage of land affected by soil degradation*

### 6.3.3 Soil Fertility and Acidification

The fertility of Tanzanian soils varies across regions. Some areas have nutrient-rich soils, while others are deficient in essential elements. Soil fertility decline is influenced by factors like erosion, leaching, and nutrient depletion due to intensive farming. Soil acidification is also a major problem in Tanzania, as approximately 4.7 million hectares of its cropped land exhibit soil acidity (pH<5.6) (IFDC, 2018). Acid soil can compromise nutrient absorption by plants and exacerbates nutrient deficiencies, affecting crop yield (such as rice and maize) as a result, compromising food security for 80% of the Tanzanian population (Peter M. Rogers, 2022).

### 6.3.4 Pesticides use

A study published in the Malaria Journal highlights the frequent use of insecticides by farmers, especially in irrigated rice systems, due to higher pest infestations. During the dry season, insecticides are often re-applied twice a week. Before planting rice, herbicides such as glyphosate are commonly used to control weeds, while selective herbicides like 2,4-D Amine are applied during the weeding process. Insecticides are the most frequently used pesticides, accounting for 59.6% of usage, followed by herbicides at 27.9% and fungicides at 10.6%. Common insecticides include lambda-cyhalothrin and chlorpyrifos. Glyphosate is the most frequently used active ingredient in herbicides, utilized by 76.8% of rice farmers. Many farmers have reported a decrease in the effectiveness of pesticides, leading to frequent re-application or mixing of different pesticides to enhance efficacy. Unsafe practices, such as improper storage and disposal of pesticides in unlabelled containers or near water sources, pose significant environmental and health risks.

There is a considerable lack of awareness among farmers regarding the proper use and dosage of pesticides. Many rely on pesticide retailers for instructions instead of reading product labels. The study underscores the urgent need for better education and regulation of pesticide use among farmers to mitigate health risks and environmental impacts while improving pest management strategies in Tanzania (Nancy S. Matowo, 2020).

Source: Nancy S. Matow, 2020

*Figure 6-8 Pesticides mixing, application and disposal practices among farmers observed in rice paddies*

A document elaborated by Agenda 4 in collaboration with IPEN in 2019 reported that Tanzanian regulations still permit the use of numerous active ingredients that are currently banned by the EU and other countries (see table below)

*Table 6-2 Tanzania - Pesticide use*

| Active ingrediant | Use | WHO Class (under specified dosage) | Countries where it is banned |
|---|---|---|---|
| Acephate | Constituent in 8 registered products. Primarily used for horticulture, such as cultivating roses and beans. | II | The substance is banned in the EU and in China. It is also banned in Sweden since 1992 (classified by the EPA as "possible human carcinogen.") |
| Azocyclotin | Used mainly for horticultural crops (roses). | II | The substance is not approved for use in the EU (and has never been used in Sweden). |
| Bendiocarb | Registered in Tanzania, for use against mosquitoes. | II | Not approved for use in the EU. |
| Fenitrothion | Registered in Tanzania in 19 products. Used in coffee, corn and in household pests. | II | Banned in the EU for health and environment concern. Use in Sweden ended before 1995. |
| Diafenthiuron | 4 products registered in Tanzania, for use in horticulture (roses, cabbage, etc.). | III | Not approved in the EU. |
| Diazinon | 12 products registered in Tanzania, mostly for vegetables, and to some extent also for coffee, sugarcane, and tobacco and household bugs. | II | Banned in the US$pean Union and Mozambique due to harmful effects on human health and the environment. |
| Fenvalerate | 3 products registered in Tanzania, for use in cotton and tomato production. | II | Not approved for use in the EU. |

*Source: IPEN*

### 6.3.5 Deforestation

Tanzania has approximately 51% forest cover (World Bank , 2021). However, the country experiences an annual deforestation rate of about 1%, which translates to around 400,000 hectares lost each year. Remarkably, this rate is twice the world average of 0.5% per year. Between 1990 and 2010, Tanzania lost 19.4% of its forested land, equivalent to approximately 8 million hectares (PROJECT GAIA, 2015).

Small-scale agriculture, particularly maize cultivation, is the primary cause of deforestation in Tanzania. Other contributing factors are none other than charcoal production, pole cutting, and timber harvesting. These activities often occur during the process of clearing land for agriculture but primarily lead to forest degradation rather than outright deforestation (Tanzania Forest Conservation Group, 2020).

*Source: ecohubmap*
*Figure 6-9 Tanzania – Deforestation*

### 6.3.6 Genetically Modified Crops

In Tanzania, the adoption of genetically modified (GM) maize varieties is already widespread. These varieties have been shown to increase crop yields, reduce pesticide and insecticide use, and decrease the cost of production (Juliana Erika de Carvalho Teixeira Yassitepe, 2021). As for rice, the adoption of improved varieties has also been observed, although specific information on GM rice adoption in Tanzania is not readily available. However, results based on DNA fingerprinting analysis reveal widespread diffusion of improved maize and rice varieties in the country (Leonard Oruko, Diiro Gracious, Fred Tairo and Sam Amanquah, 2015). Notably, the Federal government approved the commercial release of the transgenic insect resistant, and drought tolerant maize varieties known as TELA maize: four GM maize varieties: SAMMAZ 72T, SAMMAZ 73T, SAMMAZ 74T, and SAMMAZ 75T. The release and registration of the four varieties follows the approval of environmental clearance granted by the National Biosafety Management Authority (NBMA) in October 2021 (Juliana Agbo, 2024).

## 6.4 SOCIAL RISKS ANALYSIS

### 6.4.1 Labour and Working Conditions

**Risks associated with Smallholder farming:** Smallholder farmers face the following challenges: unable to afford improved inputs, lack of access to modern farming technologies, and public extension services for quality technical support and training. Many smallholder farmers lack knowledge and possibilities to manage use of pesticides as prescribed by the manufacturers. Improper use of pesticides is a major health concern for smallholder farmers producing rice and maize in Tanzania. Individual/small companies who normally make informal contracts with farmers on seasonal basis

**Unions for Rice and Maize:** Tanzania has many unions that fight for farmers' rights by providing access to resources and supporting agricultural development. Key farmers unions and cooperatives in Tanzania include Tanzania Federation of Cooperatives, Agricultural council of Tanzania, Southern Agricultural Growth Corridor of Tanzania, among others. Many non-unionized farmers struggle with limited access to markets, leading to difficulties securing fair prices for their produce and a lack of bargaining power. These farmers also face obstacles in obtaining credit services due to perceived higher risks, which limits their ability to invest in quality inputs and technology.

**Migrant workers:** Tanzania has both internal and international migrants. These originate from the East African countries including Burundi, Democratic Republic of the Congo, Kenya, Mozambique. Top destination countries for migrants from Tanzania are United States of America, United Kingdom, Rwanda, Kemya and Burundi. Foreign or migrant workers in Tanzania have a right to sue their employers because of poor working conditions that don't comply with the labour code. However, the government has not adequately monitored or enforced these labour standards, especially in the informal sector where workers are employed. Many workers lack formal employment contracts and companies often hire workers on contracts less than six months to circumvent labour protections[22].

**Occupational Health and safety:** There is widespread use of harmful pesticides in rice and maize production. The common pesticides used in maize production include: chlorothalonil + carbendazim (WHO Classification U - unlikely to cause harm), sulphur (III - Slightly Hazardous), profenofos (III - Slightly Hazardous), chloropyrifos (Ia - Extremely Hazardous), and mancozeb (U - unlikely to cause harm). Storage and application strategies for these pesticides is often poor, and they find their way into the environment through leakage, poor technology, and inefficient applications in fields. Farmers usually lack of proper protective equipment and safety measures which exposes them to occupational hazards.

### 6.4.2 Child Labour

Tanzania has ratified both the ILO Minimum Age Convention (No. 138) and the Worst Forms of Child Labor Convention (No. 182) and UNICEF's Child Rights Convention (CRC). National regulations designed to tackle child labour issues are the Employment and Labour Relations Act No. 6 of 2004, the Law of the Child Act, 2009, Child Development Policy (2008), and the National Action Plan for Elimination of Child Labour (2009). Child Development Policy to include prohibitions against the worst forms of child labour. Zanzibar is subject to the Zanzibar Employment Act which prohibits employment of children under the age of 17.

[22] Refer to: Verité | Human Trafficking Risk Factors in Supply Chains in Tanzania (verite.org)

Child labour is employed in the agriculture sector in Tanzania, and children are engaged in the worst forms of child labour including applying harmful pesticides and using dangerous tools. Child Labour in Tanzania is a pervasive issue affecting various levels and sectors across both rural and urban areas. At the household level, children are involved in subsistence agriculture, performing household chores, working as domestic helpers and contributing to family enterprises. In commercial agriculture, they work in tea, coffee and tobacco plantations. Children in urban areas are engaged in illicit activities and informal sector businesses including commercial sex, hawking, street vending, bagging and drug trafficking. Additionally, child labour has persisted in industries such as mining and fishing **(The united Republic of Tanzania, 2009)**. Child labour affects an estimated 4.2 million (29%) children aged 5-17 years. The percentage is just one percentage point lower that what was reported a decade ago, indicating that the progress in combating child labour has stalled. Majority of children engaged in child labour are involved in family-based agriculture. Nearly 95% of these children work in the agricultural sector, with approximately 93% engaged in unpaid family labour **(ILO, 2018)**. However, evidence specific to the use of child labour in maize and production is limited.

### 6.4.3 Forced Labour

Tanzania has ratified both the Abolition of Forced Labour Convention 1957 (No. 105), and the Forced Labour Convention 1930 (No. 29). National law prohibits most forms of forced or compulsory labour. These regulations include the constitution, Criminal Code, Employment and Labour Relations Act 2004 and the Anti-trafficking in Persons Act 2008.

Reports of forced labour, particularly involving children, have been noted across Tanzania, though evidence is limited. Girls in rural areas have been coerced into domestic work, while boys have been forced to work on farms, in mines and informal business sector.

### 6.4.4 Access to Land and Land Tenure

The land tenure in Tanzania is divided into customary and statutory land tenure systems. The primary legal framework is provided by Land Act 1999 and Village Land Act, 1999. These acts regulate land ownership, use and management under formal law. Land Act stipulates that all land belongs to the public but is vested in the precedent as trustee for and an behalf of all the citizens of Tanzania. The statutory system includes different types of land such as:

1. General Land is land that is not village or reserved land and is managed by commissioner for land;
2. Village act is land within the boundaries of a village, managed by the village council and governed by the Village Land Act; and
3. Reserved land is land reserved for national parks, game reserves, forests and other protected areas.

Customary tenure is prevalent in rural areas and is based on traditional practices and customs. Although all land is state owned, individuals or entities acquire rights to use land through different tenure forms including granted and customary rights of occupancy. Granted Rights of Occupancy are formal, government issued rights usually valid for up to 99 years, providing holders with legal titles that allow for transfer or mortgage. In contrast, customary rights of occupancy are derived from traditional law and are generally applicable within village lands. Although these rights are less formalized compared to granted rights they are legally recognized under Tanzanian law.

The National Land Policy of 1995 addresses the issues related to communal or rangeland by recognizing the conflicts arising from the haphazard allocation of grazing lands and large-scale agriculture, which often displaces pastoralists. Pastoralists, who are non-sedentary and frequently move in search of resources often clashes with farmers and conservation authorities. As the population increases and land degrades, there is an increasing tendency to encroach upon fertile areas such as river valleys, forests, wetlands, leading to intensified conflicts among land users including farmers and pastoralists. These conflicts undermine stability and hinder agricultural transformation. Additionally, there is widespread dissatisfaction with village land administration arising from allegations of corruption among village leaders, including producing falsified assembly minutes to allocate land to investors (Asian Development Bank, 2019).

### 6.4.5 Community Health and safety

Land degradation is a critical environmental challenge in Tanzania, significantly impacting farmers in rural areas due to adverse effects on crop production. Unsustainable farming practices, deforestation and variable are key drivers of land degradation. As a result, affected communities often face heightened undernutrition, and reduced economic stability. Evolving farming techniques and trends such as overgrazing, over cultivation and improper irrigation systems have exacerbated these risks, proving detrimental to both farmers and local communities.

Community health and safety risk also arise from:

- Widespread conversion of wetlands and native forests woodlands into agricultural and grazing land has led to destruction of the natural habitats supported by these ecosystems.
- Pesticide use can result in chronic exposure to farmers posing significant health and environmental risks. Many farmers are vulnerable due to lack of awareness about proper pesticide application techniques and insufficient understanding of the dangers associated with improper use and disposal.

## 6.5 GENERAL E&S RISK CONSIDERATIONS IN FL-RS INTERVENTION IMPLEMENTATION

The deployment of Food Loss Reduction Solutions (FL-RS) in Tanzania should be tailored to address the unique environmental and social risks identified in the country profile to ensure sustainable outcomes.

**Land Degradation and Soil Erosion**: FL-RS interventions, such as hermetic storage and biological storage protectants, are expected to mitigate land degradation by reducing the need for chemical inputs that exacerbate soil erosion and degradation. Training on sustainable post-harvest practices could help reduce the pressure to expand agricultural land into fragile ecosystems, which is a key driver of land degradation in Tanzania. Additionally, promoting better land management practices through these interventions can support efforts to restore soil health and improve crop yields.

**Labour Conditions**: The deployment of mechanical threshers and shellers as part of the FL-RS package is likely to reduce the physical burden on smallholder farmers, particularly in the labour-intensive cultivation of rice and maize. This could lead to improved working conditions by reducing the need for manual labour during peak agricultural seasons.

**Child and Forced Labour**: FL-RS interventions that improve productivity and efficiency could help reduce the economic pressures that drive child labour in the agricultural sector. By enhancing yields and reducing post-harvest losses, families may rely less on child labour to meet production targets. Moreover, promoting financial access to machinery and forming farmer cooperatives could provide economic alternatives that diminish the prevalence of forced labour.

**Access to Land and Land Tenure**: The deployment of FL-RS technologies must consider the complexities of land tenure in Tanzania. It is crucial to ensure that smallholder farmers, particularly those with customary land rights, are not displaced by new agricultural technologies or practices.

**Community Health and Safety**: The use of storage protectants and control agents of biological origin within the FL-RS strategy is expected to reduce the health risks associated with chemical pesticides.

# 7 Uganda

## INTRODUCTION

**Uganda's agricultural sector is a vital contributor to the country's economy, supporting 70% of jobs and accounting for 24% of GDP.** With a favourable climate and fertile soil, 80% of Uganda's land is arable, offering significant agricultural potential, though only 35% is currently cultivated. Smallholder farmers, representing 85% of the farming population, dominate production and primarily grow staple crops such as maize and beans (ITA, 2023). These crops are essential for food security and export, with Uganda ranking among Africa's largest producers. The country exports substantial quantities to neighboring countries, with beans leading its agricultural exports, surpassing both maize and tea. However, commercialization faces challenges due to the limited use of quality seeds, fertilizers, mechanization, and infrastructure, affecting both domestic production and export competitiveness.

**To address these issues, Uganda's agricultural sector is guided by an Environmental and Social (E&S) Policy Framework that focuses on sustainable development, food security, and economic growth.** Policies such as the National Agriculture Policy (2013) and the National Organic Agriculture Policy (2020-2025) aim to enhance productivity, value addition, and competitiveness while promoting environmental sustainability. Complementary policies, including the National Environment Management Policy (2009) and the National Climate Change Policy (2015), support sustainable resource use and climate resilience. Key legislation, such as the Uganda Vision 2040, provides a legal framework for environmental protection and sustainable practices. Regulatory bodies, including the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and the National Agricultural Research Organization (NARO), play crucial roles in policy implementation. Recent amendments to the Agricultural Chemicals (Control) Act (2024) and the Mining and Minerals Act (2022) further strengthen governance in agriculture and resource management (see section 6.2).

**Despite these policies, Uganda faces significant environmental risks impacting agriculture and livelihoods.** Water availability is a major concern, with 81% of the population lacking access to clean water, exacerbated by rapid urbanization and economic growth that have created disparities in water access between urban and rural areas (UWASNET, 2019). Land degradation and soil erosion affect 41% of Uganda's land, driven by deforestation, overgrazing, and poor agricultural practices, leading to substantial losses in agricultural productivity and economic value (UWASNET, 2019). Soil fertility and acidification issues, due to nutrient deficiencies and soil acidity, reduce crop yields and force farmers to invest more in soil amendments. Pesticide use is widespread, with many farmers relying on toxic chemicals without adequate safety measures, posing health risks and environmental concerns.

**Moreover, the agricultural sector, predominantly composed of smallholder farmers, faces significant social risks, including poor labour and working conditions, child labour, forced labour, land tenure issues, and community health and safety concerns** (ILO, 2023). Smallholder farmers often lack capital and access to agricultural inputs, making them vulnerable to changing weather patterns and economic instability. Child labour is widespread, particularly in agriculture, with nearly 39.5% of children aged 5 to 17 engaged in work, driven by poverty, health crises, and cultural norms. Despite international agreements prohibiting forced labour, trafficking and exploitation persist across various sectors. Land tenure issues complicate land ownership and often result in conflicts, with challenges such as land grabbing, absentee landlords, and fraudulent titles being common. Furthermore, the excessive use of pesticides due to limited resources and knowledge poses health and environmental risks to communities, emphasizing the need for better education and regulation in agricultural practices (Yahyah, Mbote, & Kibugi, 2024).

# LIST OF ACRONYMS

| | |
|---|---|
| AFOLU | Agriculture, Forestry, and Other Land Use |
| APD | Agricultural Planning and Developmeny |
| ATIs | Agricultural Training Institutions |
| CIAT | Center for Tropical Agriculture |
| COCTU | Coordinating Office for the Control of Trypanosomiasis in Uganda |
| DAES | Directorate of Agricultural Extension Services |
| DATICs | District Agricultural Technology and Information Centers |
| EAC | East African Community |
| MAAIF | Ministry of Agriculture, Animal Industry and Fisheries |
| NAADS | National Agricultural Advisory Services |
| NARO | National Agricultural Research Organization |
| NCCP | National Climate Change Policy |
| NDC | Nationally determined Contribution |
| WHO | World Health Organization |

## 7.1 PILLARS OF UGANDA'S AGRICULTURAL SECTOR: FOCUS ON MAIZE AND BEANS

### 7.1.1 The Agricultural Economic Landscape

Market overview

The economy of Uganda has a great potential and appears poised for rapid growth and development. Uganda is endowed with significant natural resources, including ample fertile land, regular rainfall, and mineral deposits. Which is why, Uganda's agriculture sector plays a key role in the economy; as it provides 70% of the country's jobs and contributes about 24% of GDP and 35% of export earnings (ITA, 2023). The government has identified agriculture as a key economic sector in Uganda's transition to a middle-income country, emphasizing the importance of value addition, commercialization and building resilience to climate change. Uganda's extensive agri-food system also has the potential to provide significant employment opportunities for the country's primarily young population (World Bank Group, 2018).

Investors see Uganda's agricultural potential as one of the best in Africa. Temperature fluctuations are low, the soil is fertile, and many parts of the country have two rainy seasons, allowing for several harvests per year. According to the Food and Agriculture Organization of the United Nations, Uganda's fertile farmland can feed 200 million people. As 80% of Uganda's land is arable but only 35% is being cultivated. Nonetheless, agriculture of Ugandan small household farmers is one of the sectors most vulnerable to the effects of climate change as it is highly dependent on unpredictable climate and weather and is primarily rain-fed. Projections show that agriculture will be affected by climate change, threatening food production. This, in turn, will threaten the livelihoods and food security of millions of people who depend on agriculture, especially women (CASA , 2020).

*Source: cepa.or.ug, 2024*

*Figure 7-1 Uganda – Farmers*

Dominant farming practices:

Agricultural production in Uganda primarily relies on small-scale subsistence farming, which involves approximately 4.0 million households. These farmers practice mixed agriculture. They grow both perennial and annual crops and practice pasture farming. Uganda's varied terrain and tropical climate contribute to the prevalence of subsistence agriculture, where crops such as maize, beans, cassava, sweet potato, banana, coffee, tea, tobacco, cotton and millet are grown for local consumption or for sale in nearby markets (World Bank Group, 2017).

Commercial agriculture also plays an important role, with export crops such as coffee, tea, cotton, fresh fruits, vegetables and livestock products accounting for over 80% of agricultural exports. Practices such as selection of appropriate crop varieties, crop rotation, organic fertilizers, efficient irrigation, integrated pest management and a market-oriented approach are crucial for profitable crop cultivation (Agrolearner, 2023).

Uganda produces a wide range of agricultural commodities, including coffee, tea, sugar, livestock, fish, edible oils, cotton, tobacco, plantains, maize, beans, cassava, sweet potatoes, millet, sorghum and groundnuts. Commercialization of the sector is hindered by limited use of fertilizers and quality seeds by farmers, as well as a lack of irrigation infrastructure making production vulnerable to extreme weather and pest infestations. Growth in the sector is also hindered by a lack of quality packaging facilities, inadequate storage facilities, poor post-harvest handling practices, lack of agricultural credit, high transport costs, lack of all-weather access roads in rural areas, complex and inefficient land tenure systems, and limited knowledge of modern production practices. Ugandan producers often struggle to meet the sanitary and phytosanitary standards required to export goods to US$pe and the United States. Ugandan poultry, sugar and dairy products are subject to export restrictions from Kenya.

Internal-Export dynamics

The Ugandan government aims to achieve competitive agricultural exports in the long term. This relates to several issues discussed under a separate heading, starting with Uganda's current and future competitive advantages. Uganda's favourable climate (allowing rain-fed agriculture for most of the year) and cheap rural labour enable it to export a wide range of non-traditional agricultural products at competitive prices.

Uganda exports two types of non-traditional agricultural products - bulky perishables (e.g. sweet potatoes) and maize and beans - but these products are not competitive. Bulky perishables cannot be exported without losses due to fraudulent airway bills. Exports of maize and beans were mostly casual, due to wars and droughts in neighbouring countries and handled by the World Food Programme (Dijkstra, 2001). Uganda's agricultural sector is heavily dependent on cash crops, which are grown primarily for export and play a key role in the country's economy.

- Coffee: Coffee is Uganda's most important export crop and a significant source of foreign exchange. The country is one of Africa's largest coffee producers, growing both Arabica and Robusta varieties (Senyonyi, 2018).
- Tea: Tea is another important cash crop, grown primarily in the Western and Central regions. It is exported to a variety of international markets.
- Cotton: Cotton is traditionally a cash crop in Uganda, used domestically and for export it is the third crop to contribute to small farmers livelihoods after tea and coffee. It supports the textile industry and provides income to many smallholder farmers (UNCTAD, 2019).
- Tobacco: Tobacco is grown in several regions in the North and Mid-western areas of the country and is a significant export product (Adelaine Karemani, 2019).
- Cocoa: Cocoa production in Uganda is increasing and efforts are being made to increase the quality and quantity of cocoa for export markets (NAADS, 2020).
- Vanilla: Vanilla is a high value crop gaining popularity among Ugandan farmers. It is primarily grown for export due to its high demand in international markets and its very high price (Monitor, 2021).
- Flowers: Uganda also exports horticultural products including fresh cut flowers which are grown by large companies and contribute significantly to export revenues (Britannica, 2024).

### 7.1.2 Maize Crop overview

Market analysis:

Maize is one of the staple crops in Uganda, it's one of Uganda's non-traditional exports and food security commodities, providing more than 45% of the country's daily calorie intake. The crop was introduced in Uganda in 1861 and has been an important part of the agricultural system ever since. It is the third most important cereal crop in the country (after finger millet, sorghum, and maize). To meet domestic demand, most farmers grow maize on their farmland. Small-scale farmers dominate maize production, accounting for the largest share. These farmers make up about 80% of the rural poor according to (NAADS, 2020), Maize is grown in every region of the country and provides a direct source of livelihood to over 2 million households, over 1,000 traders/merchants and over 600 millers. It has become an increasingly important non-traditional export crop, particularly benefiting smallholder farmers. Maize is therefore an increasing source of household income and foreign exchange through exports. Increasing support for the maize industry is therefore a key part of Uganda's strategy to strengthen its position in the regional and global markets. The majority of maize production was destined for export markets in the region, especially Kenya, and South Sudan, which had a chronic maize shortage in 2010.

Maize is counted among other produced grains in Uganda, next to millet, sorghum, rice and wheat, the grain market size in Uganda is currently at 3.91 billion US$s and is expected to reach 4.8 billion US$ by 2029. The Ugandan government extended in 2022 the ban it imposed in 2021 on the export of grains and other agricultural products. The latter imposed high taxes to prevent food exports to neighbouring countries, ensure food security when it comes to grains for human consumption and increase local poultry and livestock production. Another reason for the ban is the high price of grains, partly due to Russia's war with Ukraine. Uganda is now focused on expanding local production to ensure adequate supplies and productivity (ModorIntelligence, 2024).

On top of the national ban of grain exports in Uganda, Kenya imposed import restrictions on maize in March 2021 due to low quality standards of Ugandan maize, but the ban was lifted in May 2021. Following the ban, the quality and quantity of exports have improved. Only grains that have been tested by accredited laboratories in Uganda and proven to meet acceptable safety standards are allowed to be exported to Kenya, which is expected to drive market growth during the forecast period. Domestic maize production has also increased significantly.

In 2024, Uganda is projected to produce approximately 3.26 million metric tons of maize (AfricaAgricultureWatch, 2024). Regarding exports, Uganda exports a significant portion of its maize to neighbouring countries. For instance, in 2024, Uganda has received an expression of interest to export up to 500,000 metric tons of maize to Zambia (The EastAfrican, 2024). Additionally, in 2021, Uganda has signed an agreement to export 600,000 metric tons of maize to Kenya annually right after lifting their import ban (Business Insider Africa, 2021).

Dominant farming practices and value chain:

Maize cultivation in Uganda is highly diverse, with both small-scale and large-scale farming occurring. Maize cultivation in Uganda is highly diverse, with both small-scale and large-scale farming occurring. Agricultural production in Uganda is characterised by low levels of mechanisation, with only 10% of farmers using any form of mechanisation.

Small-scale farming is the most widespread. Approximately 90% of maize production occurs on small farms. These farms constitute close to 86% of the country's farming households (Louis J. M. Obura, 2020). Traditional methods are frequently used, with seeds planted by hand and spacing maintained according to local custom. Weed control is usually done by hand, and pest control relies on local knowledge and available resources. Harvesting is also done by hand, and maize is often dried in the sun before storage. Smallholder farmers face challenges including limited access to quality seeds, fertilizers and modern agricultural machinery. Most small farmers cannot afford modern farm machinery, which is essential to boost

production, so they need low-cost machines that can handle labour-intensive tasks such as ploughing, planting and weeding to boost production, especially of maize.

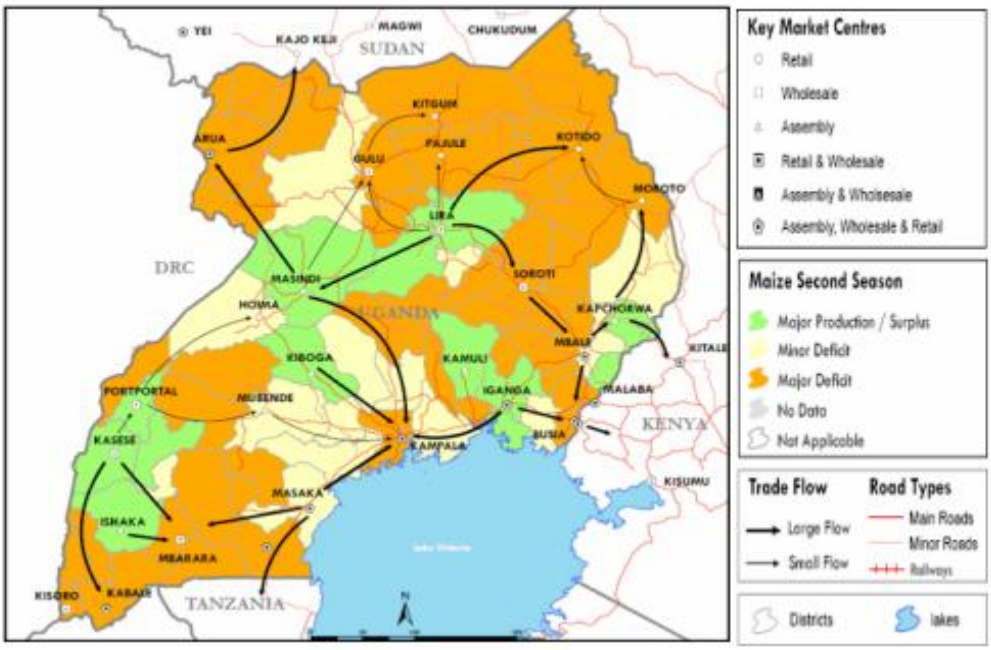
Large-scale agriculture is less common, but it is growing with companies such as Agilis Partners leading the way. Large-scale farms use mechanized equipment for soil preparation, planting, and harvesting. They employ the latest techniques, such as the use of hybrid seeds and precise planting methods to maximize yields. Large-scale operations use chemical herbicides and insecticides, as well as integrated pest management strategies. Harvesting is done mechanically, and storage silos and grain handling equipment are used for post-harvest processing. Large-scale agriculture benefits from economies of scale, greater access to markets, and the ability to invest in infrastructure and technology (BusinessFocus, 2019).

*Source: enterprise-development.org, 2018*

*Figure 7-2 Farmers threshing maize*

Regional focus areas:

Smallholder farmers in Uganda have traditionally grown maize for food and income generation. It is an important part of the agricultural system, especially in eastern Uganda. Maize is widely grown in Uganda. The main agro-ecological production zones are in the west, east, north and south-east of Uganda, with the eastern region accounting for more than 50% of annual production. The plant is cultivated on approximately 1.5 million hectares of land. In terms of area cultivated, maize is the third most widely grown cereal after bananas and beans. Currently, in some parts of the country, the plant has become a staple food, replacing cereals such as sorghum, millet, cassava and bananas. Maize is currently considered a major source of income in Kapchorwa, Mbale, Iganga, Masindi and Kasese districts. About 75-95% of household crops are sold to earn money.




*Source: FEWSNET,2012*

*Figure 7-3 Production and flow of maize*

### 7.1.3 Beans Crop overview

Market analysis: The common bean, scientifically known as *Phaseolus vulgaris L.*, is an important legume in Uganda (NAADS, 2024). Uganda ranks among the largest bean producers in Africa, following Tanzania. In 2016, Uganda produced approximately 1,008,410 tonnes of beans on 670,737 hectares. By 2017, production had increased to about 1,104,770 tonnes. Beans play a significant role for Ugandan farmers, contributing to both food security and income. With an estimated annual per capita consumption of about 58 kg, beans are a staple food in Uganda (CASA , 2020).

Despite the high local demand, Uganda produces enough beans to satisfy domestic consumption and still be a net exporter. The country exports a large portion of its bean production to neighbouring countries such as South Sudan, Kenya, and the Democratic Republic of Congo. In 2017/18, Uganda exported 349,120 tonnes of beans to East African Community (EAC) countries, generating approximately 126 million US$ in revenue. Bean exports increased from 157,152 tonnes in 2015 to 200,000 tonnes in 2017. Among Uganda's exports to EAC countries, beans surpass other major commodities such as maize and tea. Trade trends are influenced by regional demand, with Uganda playing a key role in supplying beans to its neighbors. (BusinessFocus, 2019).

Dominant farming practices and value chain: Beans in Uganda are primarily grown for subsistence, accounting for 60% of the total harvest. Smallholder farmers are the backbone of bean production, cultivating most of the crop on plots ranging from 0.1 to 4 hectares, with an average of 0.4 hectares per household. In Uganda, 85% of all farmers are smallholders, followed by medium-sized farmers who cultivate plots of 5-15 hectares (12%), and a small percentage (3%) who farm more than 15 hectares. These smallholder farmers typically own a few livestock, raise animals, and produce fish primarily for their own consumption, with a small surplus available for the market. Farming is labor-intensive and often relies on rudimentary techniques, such as using hoes for soil preparation. In Uganda, farming activities are predominantly carried out by family members, particularly women and children, as opportunities to hire farm workers are limited.

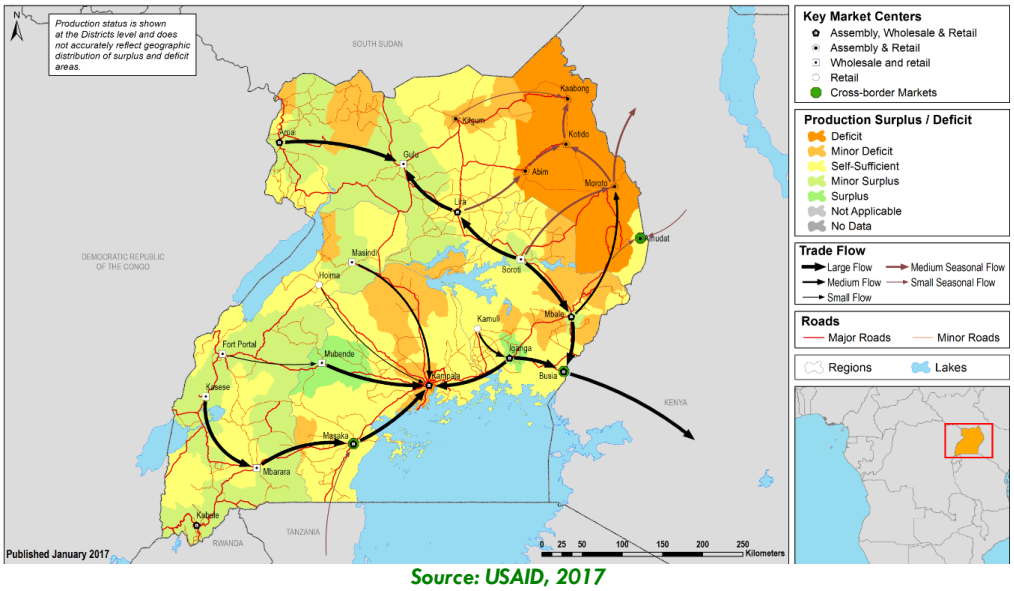
Despite the introduction of high-yielding bean varieties, many smallholder farmers continue to use low-quality recycled seeds or grains as planting material. Some semi-commercial farmers, however, purchase seeds from seed companies, registered

input dealers, or local seed producers. To improve yields, some farmers apply agricultural inputs, such as foliar fertilizers and pesticides. Soil preparation is a crucial aspect of bean production and involves labor-intensive work. Gardens are finely tilled with hand hoes to ensure a clean seedbed, although semi-commercial farmers may use tractors for land preparation (CASA , 2020). Beans are typically transported to markets in bags via motorcycles, pickup trucks, or small trucks. Smallholder farmers, especially women, often sell their products to local traders at low prices due to a lack of transportation options to reach market centers.

*Source: Flickr, 2024*

*Figure 7-4 Bean farmer*

Regional focus areas: Southwestern Uganda is the major bean producing region, accounting for about 44% of the country's production. The main growing areas include Isingiro, Kabale, Kamwenge, Kisoro, Ntungamo and Ibanda. High population density and land fragmentation are typical characteristics of this region, especially Kabale and Kisoro. Both dwarf and climbing bean varieties are cultivated in this region. Climbing beans are mainly grown in the highlands where population density is highest and cultivation area is limited. These beans are being promoted by the International Center for Tropical Agriculture (CIAT) and their introduction aims to address the problems of soil degradation and land scarcity while enhancing food security.




*Source: USAID, 2017*

*Figure 7-5 Uganda - Beans production and trade flow map*

### 7.1.4 Post-Harvest Food Loss Analysis – Maize and Beans

In Uganda, maize losses are reported throughout the post-harvest process. Harvesting leads to a 6.40% loss, while shelling and threshing result in a 1.30% loss. Additional drying adds 4% to the total loss, household storage incurs a 2.60% loss, and transportation from the field and to the market contributes to 2.40% and 1.70% losses, respectively, as reported by APHILIS.

For beans, harvesting losses range from 0.97% to 3.6%, often due to dry pods shattering, oversight, and theft by laborers. Shelling and threshing cause a 4.10% loss, mainly due to mechanical damage and spillage. Household storage losses range from 0.09% to 8.5%, with the higher end often due to pests, rodents, and mold. Transport from the field causes a 0.71% loss, primarily from theft and spillage, according to FAO, WFP, and IFAD (2019).

## 7.2 E&S POLICY FRAMEWORK

### 7.2.1 Agricultural National Strategies

National Agriculture Policy (2013): It is an overarching national agriculture policy which aims to increase production and productivity; value addition and competitiveness to Uganda's agricultural products. The overall objective of the policy is to achieve food and nutrition security and improve household incomes through coordinated interventions that focus on enhancing sustainable agricultural productivity and value addition; providing employment opportunities and promoting domestic and international trade. The policy framework also provides for the development and implementation of other commodity and/or sub sector specific policies for purposes of providing detailed guidance to those sub sectors.

National Organic Agriculture Policy: It is cross-sectoral document covering the period of 2020 – 2025. The vision and goal of the policy is to resonate with issues of sub sector transformation, competitiveness and environmental sustainability while contributing significantly to economic development, food and nutrition security and human well-being. This policy outlines targets set to propel the sub sector outcomes beyond what has been attained with the past and current policy practices. The key stakeholders targeted by this policy are mainly public institutions; ministries of Agriculture and Trade; Uganda Export Promotions Board; Uganda National Bureau of Standards; research institutions and academia; Uganda Coffee Development Authority; Cotton development Organization; export companies; NGOs; CBOs; and private Universities. The specific objectives of the policy are:

- Strengthening organic agriculture research, appropriate technology and development and utilization;
- Promoting production, processing and marketing for organic products;
- Enhance appropriate post-harvesting handling practices and value addition to organic agricultural products;
- Promote standards, certification and accreditation of organic agricultural products; and
- Strengthen environmental conservation, indigenous biodiversity and sustainable use of natural resources.

The policy also addresses several cross-cutting factors such as environmental, gender equity and youth participation, technical capacity, finance and other issues.

National Environment Management Policy (2009): The policy aims to protect and provide measures to sustainably utilize important natural resources including land, water, wetlands, forests, fauna and flora for the benefit of the present and future generations.

National Land Use Policy (2014): This policy provides for the sustainable use of land to meet the agricultural, urbanization, habitation and other environmental development needs of the present and future generations. A number of legislative instruments have been formulated to support the implementation of this policy. These tools include regulations on Environment Impact Assessment (EIA); Standards for Discharge of Effluent into Water or on land; regulations on waste management; management of hilly and mountainous areas; regulations on wetlands, riverbanks and lakeshore management; minimum standards for management of soil quality; and management of Ozone Depleting Substances and Products (ODSs), among others.

National Fertilizer Policy (2016): The policy is a comprehensive framework guiding the fertilizer related matters for productive and sustainable agriculture. The policy provides for use of both organic and inorganic fertilizers to increase soil fertility with the aim of increasing production of agricultural products to sustain the domestic and international market demands. Organic

Agriculture promotes multifaceted benefits of organic fertilizers including production of safe food, reduction of environmental contamination, maintenance of soil fertility, and reduction in the use of external inputs.

National Seed Policy 2018: The policy provides a framework for enhancing the performance of the seed-subsector in Uganda. The policy aims to ensures access and utilization of quality seed to increase agricultural production and productivity. The specific objectives of the policy are:

- To strengthen research and development for the seed sector.
- To strengthen capacity of the key players along the seed value chain to achieve an effective and efficient seed sector.
- To strengthen the seed quality control system along the entire value chain.
- To enhance knowledge and information management for the seed sector.

National Adaptation Plan for the Agricultural Sector (2018): The plan is guided by the Uganda Vision 2040, and National Development Plan and the agricultural sector plan. The vision of the plan is to ensure a climate resilient and sustainable agricultural sector contributing towards achievement of the Uganda Vision 2040. The Mission of the plan is to reduce vulnerability and enhance adaptive capacity of Uganda's agricultural sector to the impacts of climate change in order to achieve sustainable agricultural development.

National Irrigation Policy (2017): This is an overarching policy that regulates irrigation development in Uganda. The policy establishes a clear system to streamline services and processes for promotion of irrigation, improving technical information sharing and simplifying decision making in the irrigation sector. The policy aims to transform the agricultural system through irrigation development by ensuring sustainable availability of water for irrigation and its efficient use for enhanced crop production, productivity and profitability that will contribute to food security and wealth creation.

National Water Policy: It is a policy that outlines a framework to support management of Uganda's water resources in an integrated and sustainable manner to the present and future generations. The policy seeks for the formation of water committees; Local Governments partnering with user groups in operating, maintaining and managing water systems and protection of natural resources with assistance of extension staff.

National Climate Change Policy (NCCP), 2015: The goal of the NCCP is to ensure a harmonized and coordinated approach towards a climate-resilient and low-carbon development path for sustainable development in Uganda. The overarching objective of the policy is 'to ensure that all stakeholders address climate change impacts and their causes through appropriate measures, while promoting sustainable development and a green economy.

### 7.2.2 Key Legislation

Constitution of the Republic of Uganda 1995: It is the supreme law of the Republic of Uganda and was promulgated on October 8, 1995. It is providing the legal framework for the organization and functioning of the government as well as the protection of citizen's rights. Article 39 of the Constitution of the Republic of Uganda (1995) guarantees the right of every person in Uganda to a clean and healthy environment. Article 245 states that "Parliament shall, by law, provide for measures intended: (a) to protect and preserve the environment from abuse, pollution and degradation; (b) to manage the environment for sustainable development; and (c) to promote environmental awareness". Chapter 15 affirms the role of the government to promote sustainable development and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for the present and future generations. The Constitution also makes provision for right to food security and nutrition and clean and safe water.

Uganda Vision 2040: The Uganda Vision 2040 lays out the general development objectives for Uganda over a 30-year period. The Vision 2040 is conceptualized around strengthening the fundamentals of the economy to harness the abundant opportunities around the country. The Vision addresses the strategic challenges that constrains Uganda's socio-economic development since independence. These are: ideological disorientation, weak private sector, underdeveloped human resources, inadequate infrastructure, small market, lack of industrialization, underdeveloped services sector, underdevelopment of agriculture, and poor democracy, among others. Agricultural development is a highly prioritized as well as tapping into the youth demographic dividend.

Seeds and Plant Regulations, 2016: These regulations are to promote, regulate and control plant breeding, variety release, multiplication, conditioning, marketing, importing and quality assurance of seeds and other planting materials and for other related matters.

Agricultural Chemicals (Control) Act, 2006: The Act controls and regulates the manufacture, storage, storage, distribution and trade in, use, importation and exportation of agricultural chemicals and for other related matters. This Act makes provision for the production, handling, import, export and placing on the market of agricultural chemicals and establishes the Agricultural Chemical Board and the Agricultural Chemicals Technical Committee.

Plant Protection and Health Act: The Act consolidates and reforms the law relating to protection of plants against destructive diseases, pests and weeds. The specific objectives of the Act include:

- To prevent the introduction and spread of harmful organisms that may adversely affect Uganda's agriculture, the natural environment and livelihood of the people;
- To ensure sustainable plant and environmental protection;
- To regulate the export and import of plants and plant products and introduction of new plants in accordance with international commitments on plant protection so as to protect and enhance the international reputation of Ugandan agricultural imports and exports; and
- To entrust all plant protection regulatory functions to the Government.

The Phytosanitary and Inspection Service in the Department responsible for Crop Protection is responsible for the protection of the agricultural resources of Uganda from harmful organisms that exist in the country or could be introduced into the country.

Ministry of Agriculture, Animal Industry and Fisheries Extension Guidelines and Standards: The guidelines and standards are meant to facilitate the development of the agricultural sector in the provision of coordinated, effective and efficient agricultural extension and advisory services. The document aims to provide clear guidance among collaborations and linkages amongst the various level of the public extension (at DAES, district and sub-county), between MAAIF and local governments with the National Agricultural Research Organization (NARO), other key government ministries and agencies in the agricultural extension system to facilitate coordination and collaboration.

National Agricultural Advisory Service Act, 2001: The Act provides for the establishment of an Organisation known as the National Agricultural Advisory Services (NAADS), its composition, functions and administration. The objectives of this organization include promotion of food security, nutrition and household incomes through productivity and market-oriented farming, ensuring farmers access and utilisation of agricultural advisory services, promotion of farmer groups' capacity to manage farming enterprises, among others. The Act stipulates that farmer groups may apply to NAADs so as to benefit from its services.

National Agricultural Research Organisation Act 1992: This Act establishes the National Agricultural Research Organisation as a body corporate, defines its functions and powers and provides with respect to its administration and operations. The main function of the Organisation is to undertake, promote and streamline research in agriculture, livestock, fisheries and forestry.

National Climate Change Act 2021: The Act is aligned to the United Nations Framework Convention on Climate Change, the Kyoto Protocol and Paris Agreement. It provides for participation in climate mechanisms, measuring of emissions, reporting and verification of information, institutional arrangements for coordinating and implementing climate change response measures and financing of climate change issues.

Updated Nationally determined Contribution (NDC) September 2022: The Updated NDC presented an economy wide mitigation target in 2030 of 24.7% reduction below Business As Usual (BAU), aiming for an emission level of 112.1MtCO2e. The NDC is addressing key vulnerable sectors including water and sanitation, forestry, agriculture, energy, infrastructure, risk management, disaster risk reduction, fisheries, transport, manufacturing, industry, mining, health, and ecosystems (wetlands, biodiversity, and mountains). The updated NDC is a progression from the 22% reduction target set in the 2016 for the first NDC. Uganda's emissions profile is projected to increase from m 90.1 MtCO2e in 2015 to 148.8 MtCO2e in 2030 and 235.7 MtCO2e by 2050 under the Business-As-Usual (BAU) Scenario. The NDC is heavily reliant on the Agriculture, Forestry, and Other Land Use (AFOLU) sector, which is expected to contribute 82.7% of the total reduction. Other sectors, including transport energy, waste and industrial processes, are expected to contribute 7.56%, 6.36%, 3% and 0.4% respectively. The NDC include conditional and unconditional targets: 5.9% (unconditional target) reduction by BAU emission by 2030 will be facilitated by domestic resources, while an additional 18.8% (conditional target) is subject to the availability of means of implementation from international support such as financial resources, capacity-building, and technology transfer.

### 7.2.3 Regulatory Bodies

The agriculture sector is composed Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), its agencies, departments, agriculture training institutes and District Agricultural Technology and Information Centers (DATICs) located in District Local Governments. Other line ministries including; Finance, Planning and Economic Development, Gender, Labor and Social Development, Health, Trade, Industry and Cooperatives, Public Service, Local Government, Water and Environment, Works and Transport, Lands, Housing and Urban Development among others; Local Government (LG) Production Departments; The Private Sector; Development Partners; Civil Society Organisations (CSO); International and Regional Organizations; Academia; and Farmers (Small, Medium and Commercial).

Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)[23]: The mandate of MAAIF is to support, promote and guide production of crops, livestock and fisheries so as to improve quality and increased quantity of agricultural produce and products for domestic consumption, food security and export. MAAIF constitutes 4 directorates with 13 departments; 4 standalone departments and 3 specialized units as the main organizational entities of the Ministry described hereafter as follows.

1. Directorate of Animal Resources, with 3 departments namely: a) Animal Health; b) Animal Production; c) Entomology.
2. Directorate of Crop Resources, with 3 departments namely: a) Crop Inspection and Certification; b) Crop Production; c) Crop Protection.

[23] Ministry of Agriculture, Animal Industry and Fisheries – Ministry of Agriculture, Animal Industry and Fisheries

3. Directorate of Fisheries Resources, with 3 departments namely: a) Aquaculture Management and Development; b) Fisheries Control, Regulation and Quality Assurance; c) Fisheries Resource Management and Development (Natural Stocks).
4. Directorate of Agricultural Extension Services with 2 departments namely: a) Agricultural Extension and Skills Management; b) Agricultural Investment and Enterprise Development.
5. Stand Alone Departments namely: a) Finance and Administration (F&A); b) Agricultural Planning and Developmeny (APD); c) Agricultural Infrastructure, Mechanism and Water for Agricultural Production (DAIMWAP); d) Human Resource Management
6. Specialized Units namely: a) Procurement and Disposal of Public Assets Unit; b) Internal Audit Unit; c) ICT Unit.
7. Agricultural Training Institutions (ATIs) namely: a) Bukalasa Agriculture College (BAC); b) Fisheries Training Institute (FTI).
8. Semi-Autonomous Agencies namely: a) Coordinating Office for the Control of Trypanosomiasis in Uganda (COCTU); b) Cotton Development Organization (CDO); c) Dairy Development Authority (DDA); d) National Agricultural Advisory Services (NAADS); e) National Agricultural Genetic Resource Centre and Data Bank (NAGRC&DB); f) National Agricultural Research Organization (NARO); and g) Uganda Coffee Development Authority (UCDA)

MAAIF its Agencies, Departments, Agriculture Training Institutes and District Agricultural Technology and Information Centers (DATICs) located in District Local Governments;

Directorate of Crop Resources: The Department constitutes three (3) departments namely; Crop Production, Crop Protection and Crop Inspection and Certification. The functions of the Directorate of Crop Resources are to: -

1. Provide technical guidance for formulation and implementation of policies, plans and
2. strategies in crop production, marketing, protection, inspection and certification;
3. Support, supervise and monitor;
4. Sustainable market oriented production;
5. Crop pests and diseases control;
6. Plants and plant products quality and safety;
7. Primary processing and value addition of crop products; and
8. Improved food and nutrition security.

Crop production Department: It is comprised of two divisions: i. Crop Production ii. Food and Nutrition Security. The department is mandated to support, promote and guide sustainable market oriented production, value addition, quality assurance, and capacity building plus food and nutrition security.

1. Formulate and review policies, standards, guidelines, strategies and plans on crop production, post-harvest handling, primary processing, Food and Nutrition security.
2. Provide quality assurance on good agricultural practices and advisory services on crop production, primary processing, food and nutrition.
3. Build capacity (ToTs) of DLGs Extension workers on crop production, primary processing, food and nutrition.
4. Support the provision of improved seed/planting materials and suitable use of natural resources.

5. Conduct food and nutrition security surveillance in the country.
6. Develop and guide implementation of programmes for integration of the women and youth in crop production, primary processing and value addition.

**Directorate of Agricultural Extension Services (DAES):** It is mandated to reorganize the agricultural extension service into a harmonized, well-coordinated and integrated delivery system. Department of Extension and Skills Management (this department has three divisions namely: Division of Information Communication, Division of Skills Management and Division of Agricultural Extension Coordination). Department of Agricultural Investment and Enterprise Development (with two divisions: Division of Agribusiness Services and Division of Primary Processing and Value Addition).

The department of Agricultural Investment and Enterprise Development has several functions, and these include:

- Policy formulation and reviews on matters related to agricultural extension
- Strengthen coordination of local government production departments, NGOs and private sector in provision of agricultural extension services
- Provide technical advice on agricultural extension and advisory services
- Setting standards for service delivery in local governments and private sector
- Quality assurance of agricultural extension services 6. Provide information and communication services to MAAIF and local governments
- Strengthen inter-institutional linkages between research, educational and farmer institutions a) Support farmer institutional development through capacity building programs b) Support skilling and manpower development in the agricultural sector.

**National Agricultural Research Organization (NARO):** It is an agency under the Ministry of Agriculture Animal Industries and Fisheries (MAAIF) mandated by the National Agricultural Research (NAR) Act 2005 to undertake research in all aspects of Agricultural activities in Uganda including crops, livestock, fisheries, forestry, agro-machinery, natural resources and socioeconomics. The vision and mission statement of NARO emphasize a competitive society supported by a dynamic agricultural research innovation system and innovation for sustainable agricultural transformation. The goal of the organization is to increase total factor productivity and access to agricultural research products and services for inclusive growth. It is comprised of the Council as its governing body, committees of the Council as its specialized organs, and a Secretariat for its day-to-day operations. It has sixteen (16) semiautonomous Public Agricultural Research Institutes (PARIs). These include seven (7) National Agricultural Research Institutes (NARIs) with a national research mandate, and nine (9) Zonal Agricultural Research and Development Institutes (ZARDIs) mandated to carry out applied and adaptive research for a specific agro-ecological zone.

**National Agricultural Advisory Services (NAADS)[24]:** NAADS is a statutory semi-autonomous bodies in the MAAIF, established in 2001 by an Act of Parliament (NAADS Act 2001). It facilitates efficient and effective delivery of agricultural advisory services for enhanced production and productivity. Its mandate is to support farmers with the provision of agricultural inputs for wealth Creation. The mission of the agency is to contribute to the agro-industrialisation programme through provision of agricultural inputs, postharvest handling and storage facilities, agro-processing equipment for sustained production and value addition in support of equitable wealth creation.

[24] National Agricultural Advisory Services – Agriculture in Uganda (naads.or.ug)

National Agricultural Genetic Resource Centre and Data Bank (NAGRC&DB)[25]: It is a statutory semi-autonomous bodies of the MAAIF. It was established by the Animal Breeding Act, 2001 to fulfil an aspirations in the National Animal Breeding Policy (1997) and the Action Plan for its implementation providing guidelines to all actors in the animal breeding and production value-chain. The overall goal of NAGRC&DB is to enhance the competitiveness and sustainability of the livestock industry.

### 7.2.4 Emerging Regulation

Agricultural Chemicals (Control) (Amendment) Act 2024: On July 2024, the parliament amended the following section of this Act, Section 2, Section 6, Section 9 and section 18 of the principal act. The purpose of the amendment is to mainstream the functions of the Agricultural Chemicals Board established under section 5 of the Act into the Ministry.

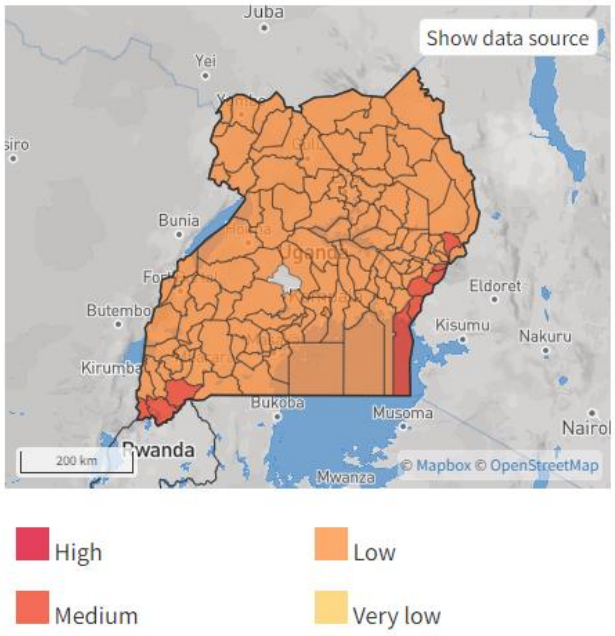
Mining and Minerals Act, 2022: Enacted on 14 October 2022, this Act consolidates and reforms the laws related to mineral resources in Uganda. It aims to strengthen administrative structures for the effective management of the mineral subsector and makes provisions for the acquisition, management, and dissemination of geological information. The Act regulates the licensing and participation of commercial entities in mining operations, ensuring government involvement in these activities.

[25] NAGRC&DB – National Animal Genetic Resources Centre and Data Bank – .Animal Genetic Solutions for Economic Transformation

## 7.3 ENVIRONMENTAL RISKS ANALYSIS

### 7.3.1 Water availability

In Uganda water scarcity is classified as medium concurring to the data that's currently accessible to ThinkHazard!. This means that there's up to a 20% chance dry spells will happen within the coming 10 a long time. There are noteworthy disparities in water get to between urban and country areas. Whereas 19% of family units have got to search for water, this gets to is much more common in urban areas compared to rural ones.




*Source: ThinkHazard!*

*Figure 7-6 Uganda - Water scarcity*

Of the country's population of 47 million, 38 million (81% of the population) have no access to clean water. Uganda has experienced two decades of economic growth that has resulted in large-scale population movements from rural areas to informal settlements around urban centers. The rapid population growth has strained existing water and sanitation services. Moreover, urban residents living in poverty pay up to 22% of their income to purchase water from water retailers. Spending such a high percentage of income on water reduces households' overall income, limiting their ability to build savings and break the cycle of poverty. And many rural families are walking more than 30 minutes to collect the water their families need, missing time from work or school (UWASNET, 2019).

### 7.3.2 Land Degradation and Soil Erosion

About 41% of Uganda's land area is affected by erosion. This erosion strips the soil of important nutrients, reducing its fertility (FAO, 2023). This is particularly severe in the highlands and livestock corridor areas, which are important for agriculture and livestock. Soil erosion rates are high, averaging 5 tons /ha per year, and can reach up to 30 tons /ha per year in the highlands. Soil erosion and encroachment result in losses equivalent to about 17% of Uganda's GDP. This is due to declining agricultural productivity and an increased need for fertilizers and other soil amendments. The main causes are deforestation, overgrazing and poor agricultural practices (Harald Ginzky, 2018). Continuing cultivation without proper soil fertility management also contributes to the problem. Climatic anomalies such as rising temperatures and changing rainfall patterns exacerbate land degradation and soil erosion. These changes can lead to crop failures and force rural inhabitants to migrate in search of better living conditions (Gray, 2020).

Soil erosion and nutrient deficiencies have caused corn and bean yields to fall well below potential production. Farmers often achieve less than what they could achieve under optimal conditions. Productivity of these crops has stagnated or declined since the early 1990s, due in part to a shift to crops that require fewer nutrients in response to declining soil fertility (Uganda, 2018).

New agricultural practices such as permanent planting ponds and rip lines have shown promise in increasing yields. These methods have been able to increase maize yields by 78% and bean yields by more than 40% compared to conventional methods. Efforts to implement sustainable land management practices are essential to reverse soil erosion trends and increase crop productivity (Olson, 2001).

### 7.3.3 Soil Fertility and Acidification

Most soils in Uganda have low to moderate fertility due to nutrient deficiencies caused by continued cultivation, soil erosion, and inappropriate fertilizer use. Soils are often deficient in key nutrients such as nitrogen (N), phosphorus (P), and potassium (K) (Birnholz, 2018). Nutrient losses are estimated at 87 kg/ha per year. Fertilizer applications are very low, averaging 0.23-1.5 kg/ha, well below the sub-Saharan African average of 8 kg/ha as only about 24% of farmers use fertilizer (CIAT, 2018). Many soils in Uganda are acidic, with pH values often below the ideal range for plant growth of 5.5 to 6.8. This acidity can limit crop productivity and affect soil health. Soil acidification is primarily caused by leaching of basin cations due to heavy rainfall, the use of acid-forming fertilizers, and continuous cropping without proper soil management. Low soil fertility and high acidity negatively affect crop yields, making it difficult for farmers to achieve good harvests. For example, maize requires a balanced supply of nutrients. Acidic soils often lack important nutrients, stunting growth and reducing yields. Beans are also particularly sensitive to soil acidity. Acidic soils can lead to poor germination and reduced nodulation, which is important for nitrogen fixation. Low soil fertility reduces bean yields. Average bean yields in Uganda are about 0.6-0.8 tonnes per hectare, but with improved soil management, yields can reach up to 1.5 tonnes per hectare. These soil problems create economic challenges for farmers as they need to invest more in soil amendments and fertilizers to maintain productivity (Moses Tenywa, 2014).

### 7.3.4 Pesticides use

Farmers in Uganda rely heavily on chemicals pesticides for pest control (Birungi, 2020), despite the promising results shown by non-chemical pest management. According to (Anna H Oesterlund, 2014) frequently used pesticides in Uganda belonged to World Health Organization (WHO) class II. Farmers did not have sufficient information about the toxicity of pesticides, and the majority did not use appropriate personal protective equipment or practice good hygiene when handling pesticides.

*Table 7-1 Uganda - Pesticide use*

| Active ingredient | Crop | WHO Classification (under specified dosage) |
|---|---|---|
| Abamectin | Tomato, watermelon, cabbage, passion fruit | Ib |
| Carbofuran | Banana | Ib (Also subject to the Rotterdam Convention) |
| Dichlorvos | Cabbage, maize | Ib (Also subject to the international programme on chemical safety, Geneva, 1980) |

*Source: IPEN, 2021*

Although the authorities make efforts to ban substances in accordance to international regulations (carbofuran, dichlorvos, fenitrothion, gramoxone etc.), farmers in Uganda continue to use some of these substances.

Use of banned substances isn't the only problem regarding pesticide use in Uganda. More severe issues are also linked to use of inappropriate application techniques such as inappropriate dosage, pesticide mixing and non-compliance to pre-harvest intervals etc (Birungi, 2020).

### 7.3.5 Deforestation

In 1990, Uganda's forest area was estimated at 24% of the country's land area (FAO, 2019) . By 2015, this share had fallen to 12.4% and is currently at 9%1. Over the past two decades, Uganda has lost over one million hectares of forest area, nearly one-third of the country's total land area (International Monetary Fund, 2022).

Uganda has one of the highest rates of deforestation and forest degradation in the world. Between 1990 and 2015, natural forest area fell from 30% to 10% of the country's land area. The highest rates of deforestation were from 2005 to 2010, with approximately 200,000 hectares lost per year. It is particularly notable that much of this deforestation occurred outside protected areas (UN-REDD, 2017). Large-scale deforestation has made prolonged droughts and erratic rainfall patterns more common. Uganda is home to at least 4,900 species of vascular plants, and loss of tree cover has implications for biodiversity and climate (ecohubmap, 2024).

*Source: africa-press.net*

*Figure 7-7 Uganda – Deforestation*

### 7.3.6 Genetically Modified Crops

Uganda has explored many Genetically Modified crops such as maize, potato, banana, cotton and cassava. However, there was no mention of genetically modified Beans in the information available online.

**GM maize:** The Uganda National Council for Science and Technology has granted approval for trials of GM maize (Monitor, 2016). These trials involve confined field testing of drought-tolerant maize and stem borer-resistant maize (Bt maize). Commercialization of GM maize is possible once a regulatory framework is established (Isaac M. Wamatsembe, 2017).

**GM Cassava:** Scientists in Uganda have developed genetically modified cassava varieties that are resistant to brown stripe and mosaic diseases, which pose a significant threat to cassava crops in East and Central Africa (Genetic Literacy Project, 2021).

**GM Potato:** Genetically modified potatoes have been developed that are resistant to late blight. Late blight is a major problem for potato growers, and these modified varieties are intended to provide increased resistance (Alliance for Science, 2021).

**GM Banana**: Uganda is working on developing a genetically modified banana that is rich in Vitamin A and resistant to bacterial wilt, which could address nutritional deficiencies and improve the plant's resilience.

**GM Cotton:** The researchers looked into genetically modified cotton plants that contained both the Bt gene (*Bacillus thuringiensis*) and the Roundup Ready gene. These traits give them increased pest resistance and herbicide tolerance (Peter Wamboga-Mugirya, 2010).

## 7.4 SOCIAL RISKS ANALYSIS

### 7.4.1 Labour and Working Conditions

Risks associated with Smallholder farming: Ugandan Agricultural sector is dominated by smallholder farmers. Nearly three quarters of the Ugandans depends on agriculture for their livelihoods. Many small-holders farmers live below the national poverty line. Smallholder farmers hold around one hectare of farmland on average. Maize and beans are the most commonly grown staple foods which are equally used for self-consumption. The main constrains of Ugandan smallholder farmers is limited capital, dependency on rain fed agriculture, lack of extension services, counterfeit agro-inputs and poor access to agricultural inputs such as fertilizers, improved seeds and irrigation schemes. Change in weather patterns has altered seasons disrupting crop seasons. The reliance on rainfed agriculture has made it increasingly difficult for farmers to predict the start of seasons or determine the optimal times for planting crops (Alum & Namulema, 2023).

**Unions for Maize and Beans:** Farmer's unions play a vital role in supporting and advocating for the interests of small-scale farmers. Some examples of unions in Uganda are the National Union of Coffee Agribusiness and Farmer Enterprises (NUCAFE), Union National Farmers Federation (UNFFE), the Uganda Cooperative Alliance (UCA), among others. There are not reports or studies that provide an estimate of farmers that are not affiliated with any agricultural union or cooperative. The non-unionized farmers face numerous challenges such as limited access to resources, support services and market opportunities compared to unionized farmers.

### 7.4.2 Child Labour

Uganda has ratified the Minimum Age Convention, 1973 (No. 138) and the Worst Forms of Child Labour Convention, 1999 (No.182). National laws also prohibits child labour under the age of 14, with exceptions of light work that does not interfere with schooling. National Program to Eliminate Child Labour (199) is a program aimed at addressing child labour issues. Despite these measures, contradictions in labour regulations and inadequate enforcement undermine the protection of children particularly in the agricultural sector.

Child labour is a significant problem, particularly prevalent in the agriculture and domestic service sectors. Child labour is widespread in various commercial fairing sectors such as tea, coffee, sugarcane, vanilla, tobacco, cotton, charcoal and palm oil production. In Uganda, children often engage in hazardous tasks such as operating dangerous tools, carrying heavy loads and handling harmful chemicals (pesticides). Child Labour has increased significantly in recent years. In 2017, 14% or 2 million of children aged between 5 to 17 were engaged in child labour. By 2022, the figure had risen to 39.5% (37.9% girls and 40.9% boys), totalling about 6.2 million children. The prevalence is particularly high in rural areas, with rates of 42.3% and regions such as Karamoja (55.6%), Lango (52%), Elgon (47%), Busoga (46%) and Acholi (45.7%) indicating the highest percents. Several factors contribute to the high prevalence of child labour in Uganda. Widespread poverty compels families to depend on their children for income, while health crises like HIV/AIDS, COVID-19 and Ebola have worsened economic difficulties. The low coverage of social protection and lack of decent job opportunities for adults exacerbate the situation. Additionally, negative cultural norms continue to perpetuate the acceptance of child labour **(ILO, 2023)**.

### 7.4.3 Forced Labour

Uganda has signed international agreements relating to forced labour, namely Forced Labour Conventions 1930 (No. 29) and the Abolition of Forced Labour Convention, 1975 (No. 105). National laws, namely the Constitution of Uganda and Employment Act 2006, prohibits all forms of forced labour. The Penal Code stipulates that anyone who unlawfully compels another person

to work against their will is committing a misdemeanour. Human traffickers exploit both domestic and foreign victims in Uganda as well as Ugandans abroad. Traffickers' subject adults and children in labour exploitation across various sectors, including agriculture, fishing, mining, street vending, hospitality and domestic work.

### 7.4.4 Access to Land and Land Tenure

Article 237 of the Constitution of Uganda stipulates that land belongs to the citizens and it is vested in them as prescribed in the land tenure system. There are four types of land tenure in Uganda, namely mailo land tenure, freehold tenure, leasehold tenure and customary tenure. The Constitution has also provided for conversion of customary land tenure to freehold land ownership by registration. Mailo tenure system is a land ownership arrangement where there is a landowner known as the landlord and individuals who occupy the land (tenants).

Each land tenure system has its own challenges as follows[26]:

1. Customary land tenure lacks formal registration which leads to issues such as land grabbing, difficulty in proving ownership and high chances of encroachment since the land is not titled;
2. Leasehold tenure often results in conflicts between lessors and lessees over lease extension, as their interests may divulge;
3. Freehold tenure is plagued by the problem of fraudulent land titles being infrequently contested in court; and
4. Mailo tenure, while popular, faces the problem of absentee landlords who can exploit the system by deliberately avoiding tenants to prevent them from paying busulu (land rent). This tactic can lead to conflicts and potential eviction of tenants. Additionally, despite land titling and registration being intended to protect land interests, evictions still occur frequently due to claims from absentee landlords that tenants have failed to pay.

### 7.4.5 Community Health and safety

Given the limited arable land and ongoing threats from pests, diseases and weeds, there has been a arise in the use pesticides to enhance productivity on existing lands. However, excessive pesticides use contaminates soil and water resources, harms biodiversity and destroys natural pest predators and diminishes food nutritional value, Many small-scale farmers in Uganda lacks financial, technical resources and knowledge necessary for proper pesticide application, leading to increased risks to local communities (Yahyah, Mbote, & Kibugi, 2024).

[26] Refer to: Land Disputes: Problems with Ownership and Rights - Uganda - Action4Justice :Uganda – Action4Justice

## 7.5 GENERAL E&S RISK CONSIDERATIONS IN FL-RS INTERVENTION IMPLEMENTATION

**Land Degradation and Soil Erosion:** With 41% of Uganda's land affected by erosion, FL-RS interventions such as training on post-harvest techniques and the use of hermetic storage technologies can help reduce the need for land expansion by improving yields on existing plots. This could mitigate further soil erosion by discouraging the cultivation of marginal lands. Training in sustainable land management practices should be included to reinforce these benefits.

**Soil Fertility and Acidification:** The widespread issue of low soil fertility and high acidity in Uganda affects crop yields, particularly for maize and beans. The introduction of hermetic bags and silos as part of FL-RS can help maintain grain quality and reduce losses, indirectly reducing the pressure to over-fertilize or expand into less fertile lands. Training on the safe use of fertilizers in conjunction with these technologies can help address soil fertility issues while minimizing further acidification.

**Pesticide Use:** Heavy pesticide use, particularly with hazardous chemicals, poses significant risks to health and the environment. FL-RS interventions should focus on promoting the use of biological storage protectants and safer alternatives. Training on the correct application and handling of pesticides, integrated pest management, and the use of hermetic storage solutions can reduce reliance on hazardous chemicals, thereby lowering the risks of contamination and health problems.

**Labour and Working Conditions:** The introduction of FL-RS technologies like mechanical threshers and shellers can significantly reduce the physical labour required for smallholder farmers, potentially improving working conditions. However, it's essential to ensure that these technologies are accessible and that farmers are trained in their safe and effective use. The project should also address potential inequalities in access to these resources.

**Child Labour:** The potential for FL-RS technologies to reduce the labour burden on families could help reduce the reliance on child labour in agriculture. However, careful monitoring and community engagement are needed to ensure that these technologies do not inadvertently increase children's workload by shifting it to tasks like equipment operation or post-harvest handling. Training programs should include a focus on child labour awareness and prevention.

**Forced Labour:** By increasing agricultural efficiency and productivity, FL-RS interventions can help reduce the economic pressures that lead to forced labour. Ensuring that these technologies are implemented alongside fair labour practices and community support mechanisms will be key to mitigating the risk of forced labour, particularly in more vulnerable populations.

**Access to Land and Land Tenure:** Uganda's complex land tenure system poses challenges for the equitable deployment of FL-RS technologies. Ensuring that these interventions are accessible to all farmers, including those with insecure land tenure, is crucial. Training and capacity-building efforts should include components on land rights and how to secure tenure, particularly for smallholder and marginalized farmers.

**Community Health and Safety:** The introduction of FL-RS technologies should prioritize reducing community health risks associated with pesticide use and land degradation. For example, hermetic storage solutions can help preserve crop quality without the need for chemical treatments, reducing exposure to harmful substances. Training on safe handling practices and the environmental impacts of agricultural technologies will be essential to protect community health and safety.

# 8 Zambia

## INTRODUCTION

**Zambia's agricultural sector is a key driver of economic diversification, providing food, employment, and income for over 70% of the population but only contributing 3.9% to GDP in 2022.** The sector's potential is underutilized, with only 15% of 42 million hectares of arable land currently cultivated. Smallholder farmers dominate, using simple technologies and rain-fed agriculture, leading to low yields and vulnerability to climate change (ITA, 2024). Maize and soybeans are the primary crops, with maize production at 3.3 million tonnes and soybean production at 475,000 tonnes in recent marketing years. Challenges include limited access to quality inputs, poor post-harvest storage, and inadequate infrastructure. Contract farming is emerging to link smallholder farmers with larger commercial entities, improving access to inputs and markets. Zambia exports significant amounts of maize and soybeans, with other important crops including cassava, sorghum, millet, peanuts, and sugar. Cash crops such as tobacco, cotton, and coffee also play a significant role in the economy.

**Zambia's E&S Policy Framework promotes sustainable agricultural development and climate resilience** (see section 7.2). Key policies like the National Agriculture Policy (NAP) 2012 – 2030 and the Second National Agricultural Policy (SNAP) 2016 focus on increasing productivity, market access, and support for small-scale farmers. The Comprehensive Agriculture Transformation Support Programme (CATSP) and Vision 2030 aim to enhance food security and economic growth. Environmental policies such as the National Water Policy, 2010, and the National Policy on Environment, 2007 ensure sustainable resource management. Climate strategies, including the National Climate Change Response Strategy (NCCRS) 2010 – 2030 and the National Policy on Climate Change 2016, aim for a resilient, low-carbon economy. Legislation like the Constitution of Zambia, 1991 supports sustainable development, while emerging regulations like the Animal Identification and Traceability Act, 2024 enhance agricultural and environmental governance.

**Zambia faces increasing water scarcity, with a projected 20% chance of droughts in the next decade and a 13% reduction in water availability by the century's end due to climate change** (Ngoma, 2019). Land degradation and soil erosion, driven by deforestation, mining, and unsustainable agricultural practices, reduce agricultural productivity and increase rural poverty (Ngoma, 2019). Soil fertility is generally low, exacerbated by soil acidification from continuous cropping and inappropriate fertilizer use. Pesticide use poses health and environmental risks due to a lack of proper training among farmers.

**The agricultural sector, dominated by smallholder farming, also faces significant social risks.** Farmers experience delayed input access, reliance on rain-fed agriculture, and limited knowledge, resulting in low productivity and job insecurity. Migrant workers in agriculture endure poor working conditions and low wages (Ministry of Labour and Social Security, 2014). Child labour is prevalent in agriculture despite legal prohibitions, and forced labour persists with traffickers exploiting vulnerable individuals. Land tenure insecurity arises from the dual land tenure system and the conversion of customary land to leasehold. Community health and safety are compromised by pesticide use and agricultural runoff, contaminating water resources and spreading diseases.

# LIST OF ACRONYMS

| | |
|---|---|
| AFOLU | Agriculture Forestry and Other Land Use |
| BAU | business as usual |
| CATSP | Comprehensive Agriculture Transformation Support Programme |
| FISP | Farm Input Support Program |
| GM | Genetically modified |
| ISTA | International Seed Testing Association |
| MOA | Ministry of Agriculture |
| N2O | itrous oxide |
| NAIS | National Agricultural Information Services |
| NAP | National Agriculture Policy |
| NBA | National Biosecurity Authority |
| NCCRS | National Climate Change Response Strategy |
| NDC | Nationally Determined Contribution |
| SCCI | Seed Control and Certification Institute |
| SNAP | Second National Agricultural Policy |

# 8.1 PILLARS OF ZAMBIA'S AGRICULTURAL SECTOR: FOCUS ON MAIZE AND SOYBEANS

## 8.1.1 The Agricultural Economic Landscape

Market overview

In Zambia, the agriculture sector has been identified as one of the key drivers of economic diversification and resilience (Kasunga, 2021). It is a key sector of the Zambian economy, providing jobs, growth and livelihoods. The agriculture sector is a source of food, employment and income for over 70% of the population (Fund, 2022). However, the sector contributed only 3.9% of GDP in 2022 (ITA, 2024).

The countries' potential when it comes to the agricultural sector remains largely untapped, due to the low agricultural productivity, limited value addition and underutilisation of arable land factors (IGC, 2023), as out of 42 million hectares of moderately-to-highly agricultural land, only 15% is currently cultivated (ZambiaInvest, 2024).

Zambia's farmers' low yields are primarily due to limited access to quality inputs, mechanization, and fund lack of awareness of improved farming practices; poor post-harvest storage; and government interference that undermines the development of predictable or commercially sustainable markets for raw materials, exports, and agricultural inputs. Zambia relies primarily on rain-fed agriculture with limited use of pesticides, making yields highly vulnerable to frequent extreme weather events caused by climate change, including floods, droughts, and pest infestations. Zambia cultivates less than 14 percent of its 40 million hectares of arable land (with medium to high agricultural production potential), and of that, only 5.7 percent is irrigated. Zambia's main crop is maize, which is expected to produce an estimated 3.3 million tonnes in the 2023/2024 marketing year. Zambia exported 1.1 million tonnes in the 2022/2023 fiscal year (ITA, 2024). Zambia's second largest crop is soybean, with about 475,000 tonnes produced in the 2022/2023 marketing year, followed by sorghum, millet, cassava, sugar, coffee, peanuts, rice, cotton and smaller amounts of other horticultural crops.

*Source: farmerama*

*Figure 8-1 Zambia - Maize Farmer*

Dominant farming practices:

In Zambia, agriculture is a significant part of the economy, with smallholder farmers forming the backbone of the sector (FAO, 2024), since around 80% of the country's food needs comes from small-scale farmers because of their focus on food crops (Judith Neilson Foundation, 2024).
Most Zambian agricultural producers are asset-poor smallholders who use simple technologies (hand hoes and oxen) and farming practices (minimal input purchases such as hybrid seeds and fertilizers). These farmers typically focus on growing essential foods for both their households and the broader community. They produce mainly maize, groundnuts, roots and tubers using rain-fed agriculture, most of which are subsistence, on less than 5 hectares (most smallholders cultivate less than 2 hectares) and tend to be low productive. Most smallholders lack access to functioning input-output markets and support services, with an estimated 50% of farmers selling their crops in a year (Siegel, 2008).

At the other end of the spectrum are large commercial farms that use modern inputs, have access to national and global input and output marketing chains, and are sometimes vertically integrated into agro processing. Large farms that use commercial labour contribute to the country's agricultural production and exports, but their relatively small numbers and reliance on labour-saving technologies limit their potential for poverty reduction through labour linkages.

Recently, however, there has been a trend towards contract farming programs (various forms of contract farming) that directly link smallholder farmers with large commercial farmers (or national or international agribusinesses) by providing inputs, credit, technical assistance, and selling their produce. The proliferation of these contract farming programs is primarily a response to the breakdown of state-sponsored agricultural systems (input supplies, agricultural market guarantees, credit, technical assistance, etc.) and the lack of private market networks to fill this gap.

Internal-Export dynamics

In Zambia, grain crop production in diversified with local production wildly covering local demand (case of maize, soybeans, cassava, sorghum, millet, groundnuts and sugar). Apart from rice production that is usually falls short, leading to imports to fill the gap.

For instance, Zambia produced approximately 3.3 million tonnes of maize in the 2023/2024 marketing year. Annual consumption of maize is estimated at more than 2.4 million tonnes (Zambian Observer, 2024). Last year's exports were estimated as 1.1 million metric tons. That's why maize is considered both as a stable and as a cash crop.

Zambia's soybean production is also doing very well. In the 2022/2023 marketing year, Zambia produced approximately 475,000 tonnes of soybeans. Although specific consumption and export data for soybeans is not readily available, production volumes indicate that local needs are likely to be met and additional volumes are available for export (de Groote, 2015).
Other crops are also produced in by Zambian farmers, such as:

- **Cassava:** Cassava is an important dietary staple for many Zambians. It is a staple food in Zambia, especially in the northern region. The country produces about 1.2 million tonnes per year. Which caters to local demand.
- **Sorghum:** Sorghum and millet production is estimated at about 100,000 tonnes per year. These grains are important for food security and are widely consumed locally. Production usually covers local consumption (IGC, 2024).
- **Peanuts:** Peanuts are also an important crop with an annual production of about 150,000 tonnes. Production is usually sufficient to meet local needs.
- **Sugar:** Zambia is a major producer of sugar, with annual production of about 450,000 tonnes. Local consumption is adequately covered by production, and there is a significant surplus available for export.

- **Rice:** Zambia's rice production is relatively low at about 40,000 tonnes per year. Local consumption often exceeds production, which leads to imports fill the gap (Kasunga, 2021). Zambia exports a significant portion of its sugar production, with annual exports around 200,000 metric tons.

Zambia has a list of cash crops that are an essential source of income for farmers and have a robust international market.

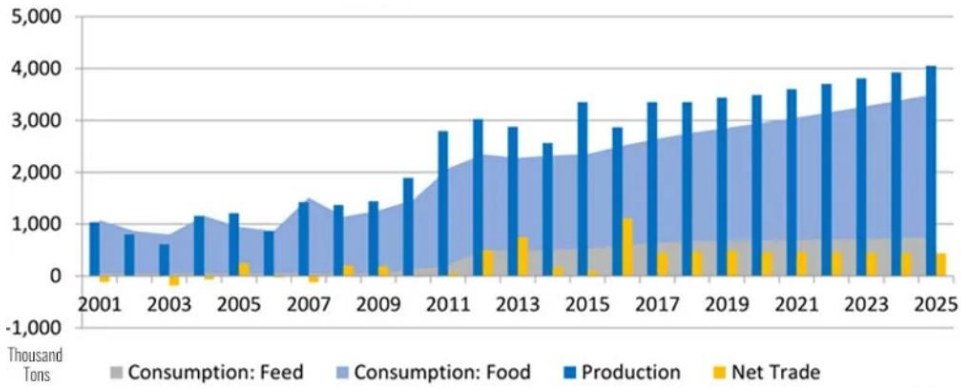
- **Tobacco:** Tobacco is one of Zambia's most profitable cash crops and has a strong international market. Tobacco has constant demand and stable market prices, making it a lucrative source of income for farmers.
- **Cotton:** Cotton is an important traditional cash crop for both domestic use and export. It supports rural communities and promotes socio-economic development (nitumezi farms, 2024).
- **Soybeans:** Soybean is versatile and is used in food, feed and industrial sectors. Demand for soybeans is high, providing farmers with a diversified source of income.
- **Maize:** as mentioned, maize is a staple food and an important cash crop in Zambia. It is widely grown and supported by government subsidies, ensuring a stable income for farmers.
- **Sugarcane:** Sugarcane is also an important cash crop, with a significant part of production being exported. It contributes to the economy through local consumption and exports (Nations Encyclopedia, 2024).
- **Groundnuts:** Groundnuts are valuable for both local consumption and export. They are used in a variety of ways, including for oil production and for food.
- **Coffee:** Coffee cultivation is growing, especially in the Northern Province. International demand for high-quality coffee offers great opportunities for farmers.

### 8.1.2 Maize Crop overview

Market analysis:

Maize is a staple food in Zambia, providing about 60% of the country's caloric intake. Most maize production is by smallholder farmers, primarily rain-fed. Zambia has generally produced maize surpluses over the past two decades, thanks to abundant rainfall and government subsidies. However, severe climatic changes can lead to production losses and food insecurity.

Domestic maize consumption in Zambia was about 2.3 million tonnes in 2015 and is expected to increase to about 3.3 million tonnes by 2025 due to population growth and rising per capita income. As a result, domestic demand for maize is expected to increase, both for food and livestock, as Zambian communities have an increasing need for protein-rich foods (Zambia Invest , 2016).



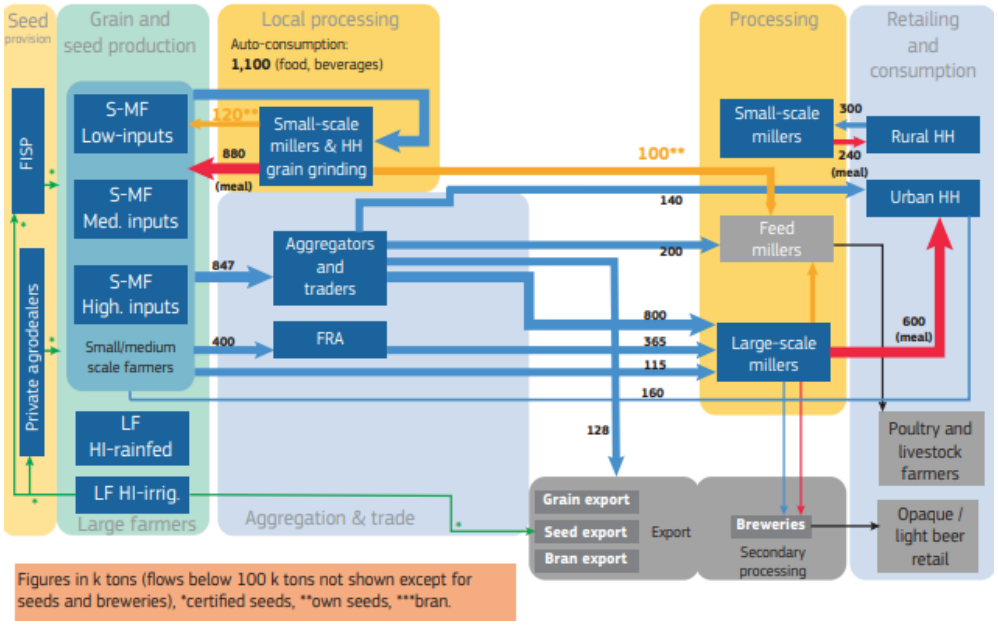

*Source: Indaba Policy Research Institute*

*Figure 8-2 Zambia Agriculture Production and Consumption*

Dominant farming practices and value chain:

Maize is Zambia's national staple food. Its production is mainly undertaken by small and medium-sized enterprises and is almost exclusively rain-fed. The coordination process for maize marketing is characterized by spot market relationships between small and medium-sized farmers and traders. There is little contract farming of maize, and government-organized

small-scale cooperatives are not involved in maize marketing. About half of the smallholder farmers benefit from subsidized supplies of fertilizer and hybrid seeds through the Farm Input Support Program (FISP), reducing their production costs. Smallholder farmers who use only small amounts of external inputs to grow maize do not benefit from subsidies and are at higher risk of food insecurity (European Commission, 2022).




Legend: S-MF: small & medium-scale farmers, LF: large-scale farmers, HI: high intensity, HH: households, DMMU: Disaster Management and Mitigation Unit, FISP: Farmer Input Support Programme, FRA: Food Reserve Agency

*Source: US$pean commission, 2018*

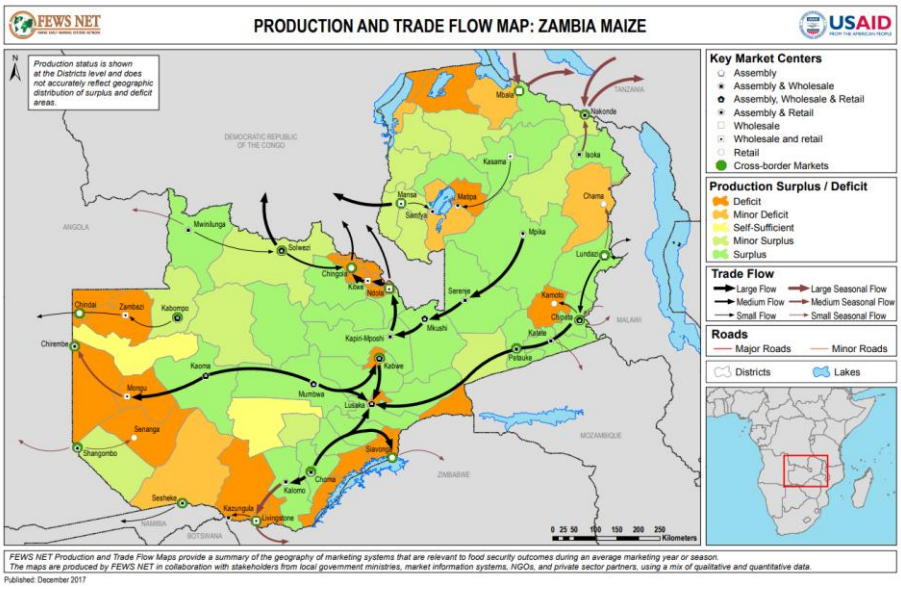
*Figure 8-3 Maize value chain*

Despite high levels of public support, maize is not very profitable for farmers who produce it commercially. Small and medium-sized enterprises suffer from resource inefficiencies and low yields. Large, mechanized farms suffer from high costs and focus on more profitable seed production than maize grain.

Downstream companies achieve high profitability but face contrasting situations: trading maize can be very profitable but suffers from high market volatility caused by the unpredictability of market interventions in grain reserves. Industrial milling is a mature business with reasonable profitability. Flour milling receive maize at subsidized prices and are therefore supported by the official grain reserve. Smaller mills exist around the country, but often operate well below capacity and are relatively unprofitable.

Regional focus areas:

In Zambia, maize is predominantly grown in several key regions. The Southern Province is the top maize-producing area, accounting for about 23.8% of the country's maize area. Other significant maize-producing regions include the Eastern, Central, Western, and Northern Provinces, which together contribute to 75.17% of Zambia's maize production (knoema, 2024).




*Source: USAID, 2027*

*Figure 8-4 Zambia - Maize production by region*

### 8.1.3 Soybeans Crop overview

Market analysis:

Soybeans are considered one of the miracle plants that provide more oil and vegetable protein than many other plants and are classified as legumes or different types of beans. They fall under the category of oilseeds for edible oil and are produced in large quantities. This plant is versatile as it can tolerate different climatic conditions and different types of soil, which is not the case for many plants (Siamabele, 2019). Soybeans are used in a variety of forms, including edible oil, soy flour, and soy milk. They are also added to family meals to increase their nutritional value. Most of the soybean meal remaining after oil extraction is used as protein-rich livestock feed.

The country is largely self-sufficient in soybean production, with most of the supply coming from commercial farmers. In fact, Zambia produces enough soybeans to meet domestic demand as well as for export to neighbouring countries and overseas. The Zambian soybean market has experienced significant growth and change in recent years (Zamseed, 2020). The main export destinations for Zambian soybeans are South Africa, Zimbabwe, and Botswana. In 2022, Zambia exported approximately 11-million-US$ worth of soybeans, making it the 40th largest exporter of soybeans globally (OEC, 2022). However, challenges remain, including market access, that can affect the efficiency of the supply chain. Infrastructure issues, such as poor transportation and storage facilities, can affect the efficiency of soybean markets. Smallholder farmers also face challenges related to weather dependency and access to quality seeds and fertilizers.

Dominant farming practices and value chain:

In addition to the above stated uses, soybean also contributes to improving soil fertility. Due to the presence of rhizobia in the root nodules, the plant fixes atmospheric nitrogen in the soil. It is recommended to alternate the cultivation of soybeans with cereals. Zambia's soybean production is increasing and amounted to about 475 million kilograms in 2022. This growth is driven by both commercial and smallholder farmers, who account for about 85% of the supply. On average, Zambian farmers harvest between 2 and 4 tonnes of soybean per hectare (Agriculture in Zambia, 2021).

Zambia's soybean value chain is multi-layered, with several key stages, each contributing to the efficiency and profitability of the sector overall. Soybean production in Zambia is undertaken by both commercial and smallholder farmers. Commercial farmers typically use advanced agricultural techniques such as irrigation and high-quality inputs, resulting in higher yields.

Smallholder farmers, on the other hand, often rely on rain-fed agriculture and face challenges such as limited access to quality seeds and fertilizers (Mngoli, 2022).

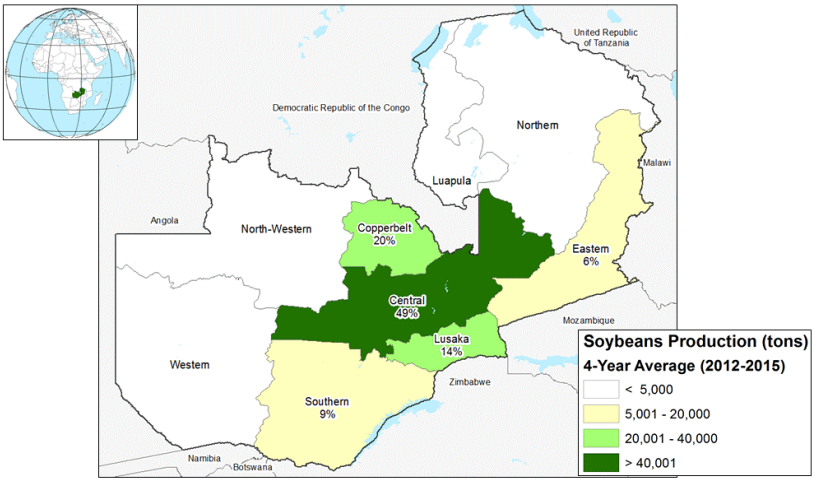
Zambia has a relatively well-developed soybean processing industry compared to some neighbouring countries. In the processing stage, raw soybeans are processed into various products such as soybean oil, soybean flour and other value-added products (FAO, 2021). This stage is very important as it adds significant value to the raw soybeans and supports the local industry. Processed soybean products are sold both domestically and internationally. Zambia exports some of its processed soybeans to neighbouring countries and benefits from regional trade agreements. The marketing and distribution stage involves logistics, warehousing and transportation which are crucial to ensure that the product reaches the target market efficiently. However, the soybean value chain faces several challenges, including inadequate infrastructure, high production costs, and limited access to capital for smallholder farmers. Additionally, there are issues with market access and competition from imported products. Despite these challenges, there are significant opportunities for growth. These include expanding production through improved farming practices, building processing capacity, and strengthening market linkages (Times of Zambia , 2023 ).

Government and private investments in infrastructure and support services can further strengthen the value chain. The Zambian government, in collaboration with international organizations such as FAO, is actively working to support the soy value chain. This includes providing training and resources to farmers, improving access to quality seeds, and promoting sustainable agricultural practices. These efforts aim to improve productivity, increase farmer incomes and ensure food security.

Regional focus areas:

Soybean is grown almost throughout Zambia but the largest producing regions are:

- **Central Province:** This region accounts for about 49% of Zambia's total soybean production.
- **Copperbelt Province:** About 20% of the total soybean production is produced in this province.
- **Lusaka Province:** Lusaka accounts for about 14% of the total soybean production (USDA, 2024).




*Source, USDA, 2024*

*Figure 8-5 Zambia - soybeans production regions 2012-2015*

### 8.1.4 Post-Harvest Food Loss Analysis – Maize and Soybeans

In Zambia, maize is subject to food losses at multiple stages. Drying and harvesting cause a 6.40% loss, additional drying adds 4%, and shelling and threshing contribute to a 1.30% loss. Household storage results in a 2.50% loss, and transportation from the field and to the market incurs 2.40% and 1.70% losses, respectively, as reported by APHILIS.

Soybeans also face significant losses, particularly during processing, which accounts for a 13% loss. Drying and shelling each contribute to a 4% loss, while post-harvest handling causes a 5.07% loss. Storage leads to a 2.74% loss, and transport causes a 0.21% loss. Across the entire supply chain, losses amount to 9.17%, according to data from Ambler et al. (2018) and the FAO Food Loss and Waste Database.

## 8.2 E&S POLICY FRAMEWORK

### 8.2.1 Agricultural National Strategies

National Agriculture Policy (NAP), 2012 – 2030: The Policy is a nationwide sectoral strategy designed to foster development of a competitive, diversified, equitable and sustainable agriculture sector. Its goal is to the national economic Vision 2030, which aims for a competitive and diversified sector driven by equitable and sustainable agricultural development.

The objectives of NAP 2012–2030 are to:

(i) Promote sustainable increase in agricultural productivity of major crops with comparative advantage;

(ii) Continuously improve agricultural input and product markets so as to reduce marketing costs of agribusiness, including small-scale farmers and farmer groups;

(iii) Increase agricultural exports to preferential markets at regional and international levels;

(iv) Improve access to productive resources and services for small-scale farmers, especially women and young farmers, in outlying areas to enable them to increase production of staple foods, including fruits and vegetables, for own consumption and the surplus for income generation;

(v) Continuously strengthen public and private sector institutional capabilities to improve agricultural policy implementation, resource mobilisation, agriculture research, technology dissemination, and implementation of regulatory services.

Second National Agricultural Policy (SNAP) 2016: SNAP provides comprehensive policy guidelines for Zambia's agricultural sector. It addresses current trends and emerging issues while tackling challenges identified during implementation of the 2004-2015 National Agricultural Policy (NAP). The policy covers essential aspects agriculture, including food and nutritional security, agricultural production and productivity, agricultural diversification, agricultural research and extension services, sustainable resource use, promotion of irrigation, agro-processing and value addition, agricultural marketing and trade, livestock and fisheries development. Additionally, it addresses institutional and legislative framework, decentralization, private sector participation, support to cooperatives and other farmer organisations and crosscutting issues such as gender mainstreaming, HIV and AIDS, and mitigation of climate change.

Comprehensive Agriculture Transformation Support Programme (CATSP): The CATSP is aligned to the National Development Plan and the Republic of Zambia Vision 2030. It was designed to translate the Government of Zambia's commitment into actionable steps for implementing the Agricultural Transformation Policy. The programme aims at benefiting rural dwellers and the whole Zambian population by creating access to quantity and quality food at a competitive price. CATSP's expected outcomes are to increase agriculture sector's contribution to economic growth, wealth creation and social welfare and increase private sector investments into the uptake of technologies.

National Water Policy, 2010: This National Water Policy revises the National Water Policy of 2004 to provide for a clear vision and holistic policy direction for the Zambia's water sector. The Policy addresses cross-cutting issues such as gender, HIV/AIDS, research development and climate change. Guiding principles of the policy include gender equity in water access. It covers various sectoral areas such as water resource management, development and usage for food, agriculture fisheries, tourism, sanitation, environment and energy.

National Policy on Environment, 2007: The overarching goal of the Policy is to establish a comprehensive framework for managing Zambia's environment and natural resources. This framework aims to ensure that these resources are managed sustainably, preserving their integrity to meet the needs of the current and future generation without compromising either. The goal and primary objective of the policy is to align with the Government's development priority to eradicate poverty and improve the quality of life of the people of Zambia. The policy aims to advance environmentally sound agricultural development by ensuring sustainable crop and livestock production through ecologically appropriate production and management techniques, and appropriate legal and institutional framework for sustainable environmental management.

National Climate Change Response Strategy (NCCRS), 2010 – 2030: NCCRS was developed to coordinate Zambia's response to climate change challenges. The strategy is aligned with the objectives of UNFCC, which Zambia ratified in 1933. The vision of the NCCRS is "a Prosperous Climate Change Resilient Economy", while the mission is "to ensure that the most vulnerable sectors of the economy are climate proofed, and sustainable development achieved through the promotion of low carbon development pathways." For Land use e (Agriculture and Forestry) and water sectors, the strategy aims to develop sustainable land use systems to enhance agricultural production and ensure food security under the changing climate, ensure sustainable management and resiliency of water resources under the changing climate.

National Policy on Climate Change 2016: It is a cross-sectoral framework aimed at coordinating climate change programmes in order to ensure climate resilient and low carbon development pathways for sustainable development towards the attainment of Zambia's Vision 2030. The policy is guided by the principle of 'sustainable climate change response which mandates that all climate change actions be environmentally sustainable and positively contribute to national economic growth and social development objectives, including poverty alleviation, access to natural resources and basic amenities, gender equality and equity and infrastructure development.

### 8.2.2 Key Legislation

Constitution of Zambia, 1991: The Constitution of Zambia is the supreme law of the republic of Zambia that was adopted on 31 August 1991. It has been amended in 1996, 2003, 2006 and 2009. The last substantial revision was done in January 2016. The Constitution of Zambia recognizes the right to property. Article 16 provides for the protection from deprivation of property and states that no property of any description shall be compulsorily taken possession of, and no interest in or right over property of any description shall be compulsorily acquired, unless by or under the authority of an Act of Parliament which provides for payment of adequate compensation for the property or interest or right to be taken possession of or acquired. Right to protection of environment and natural resources is recognized under article 256 including ensuring ecologically sustainable development and use of natura resources. The constitution classifies land as state land, or customary land in article 254.

Republic of Zambia Vison 2030: The National Long-Term Vision 2030 (Vision 2030) is Zambia's first ever written long-term plan, expressing Zambians' aspirations by the year 2030. The Vision 2030 outline the potential long term alternative development policy scenarios aimed at achieving key social economic indicators by 2030. The Vision is implemented through a series of five-year development plans with support from annual budgets. To enhance the productivity and sustainability of agriculture, forestry and fisheries, the sector envisions an efficient, competitive, sustainable and export-led agriculture sector that assures food security and increased income by 2030. To Realize this vision, the government plans to: (i) increase agricultural productivity and land under cultivation by 2030, (ii) increase exports of agricultural and agro-processed products by 2030, (iii) preserve the agricultural resource base by 2030, (iv) increase land under cultivation to 900,000 hectares by 2030, (v) increasing land under irrigation to 400,000 hectares by 2030; (vi) increase agricultural machinery, tractors per 100 hectares to 2 by 2030, (vii) increase livestock population to 6,000,000 by 2030, (viii) increase fish population to 300,000mt

by 2030, (vii) land being productively exploited for socio-economic development by 2030, and women men and the disabled have equal access to productive land for socio-economic development by 2030.

Plant Breeder's Rights Act, 2007: This Act makes provision for the definition, registration and protection of plant breeder's rights and sets out conditions and procedures for the assignment of such right and related denomination of plant varieties. The Act also designates the Seed Control and Certification Institute of the Ministry of Agriculture as the plant variety protection authority.

Plant Variety and Seeds Act (Cap. 236): It is an act to regulate and control the production, sale and import of seed for sowing and of the export of seed. It provides for the testing and for minimum standards of germination and purity thereof, and further to provide for the certification of seed and related matters. The Seed Control and Certification Institute is designated as the Certifying Authority and shall be responsible for the administration of this Act. The Certifying Authority will maintain a Register of Seed Importers and a Register of Seed Cleaners.

Agriculture (Fertilisers) Regulations (Cap. 226): These Regulations apply to fertilizers as defined in section two of the Agriculture (Fertilizers and Feed) Act. The Part II of the Act outlines the requirements of the applications, transfer or renewal of registration of plant as per the Form in the First Schedule to these Regulations. The Registering Officer is responsible for issuing a certificate of registration and maintaining a register of plant as prescribed in the First Schedule. Regulation 7 provides for approval of analysts for purposes of the Act, whereas regulation 8 provides for approval of laboratories. Other provisions concern principally labelling, marking of containers and analysis of fertilizer.

Biosafety (Genetically Modified Organisms for Food, Feed and Processing) Regulations, 2010: These regulations govern the control of the import, development, export, research, transit, contained use, release or placing on the market of any genetically modified organism to be used in food or feed or for processing. The National Biosafety Authority must authorize the import of GMOs if they do not pose any significant risks to human or animal health, biological diversity, non-genetically modified crops or the environment. The authority will establish and maintain a Register for purposes of these Regulations. A producer of a genetically modified organism for food or feed must develop a unique identifier for each genetically modified organism.

Plant Pests and Diseases Act (Cap. 233): The act provides for the eradication and prevention of the spread of plant pests and diseases in Zambia, to prevent the introduction into Zambia of plant pests and diseases, and to address related matters.

Agricultural Institute of Zambia Act, 2017: The act establishes the Agricultural Institute of Zambia, the Agricultural Council, the Agricultural Registration Board and the Disciplinary Committee, defines the functions and powers of these institutions and organs, and provides with respect to registration as agricultural professional. The act makes provision for the registration of agricultural professionals and regulate their professional conduct in the interest of the agricultural sector.

Agricultural Lands Act (Cap. 187): The Act establishes the Agricultural Lands Board with the following functions: monitoring the president's land outside urban and peri-urban areas and to make such recommendations to the Minister as deemed necessary, carrying out other duties in relation to the alienation of State Land, and to oversee and review the implementation of the Agricultural Lands Act (Cap. 187).

Revised and updated Nationally Determined Contribution (NDC): The NDC is for the timeframe 2015 – 2030 and updated in July 2021. This revised and updated NDC includes a conditional pledge to reduce greenhouse gases (GHG) emissions by 25% ((20,000 Gg CO2 eq.) by 2030 compared to a 2010 baseline 0 under the business as usual (BAU) scenario with limited international support. With substantial international support, the reduction targets increases to 47% (38,000 Gg CO2 eq.). The interventions will mainly concern the following sectors:

- Energy categories include; Energy industries, manufacturing industries and construction, transport, and other sectors;
- Agriculture Forestry and Other Land Use (AFOLU) categories include; livestock, Land and Aggregate sources and non-CO2 emissions sources on land
- Waste categories include; solid waste disposal, biological treatment of solid waste, Incineration and Open Burning of Waste, and Wastewater Treatment and Discharge.

Gases under consideration are Carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O).

### 8.2.3 Regulatory Bodies

Ministry of Agriculture (MOA)[27]: The MOA envisions becoming 'A Smart and Value-Centred Ministry of Agriculture' to revitalize its role in fostering a conducive environment for agricultural development. The vision focuses on promoting innovative approaches to enhance production and productivity. The MOA's mission is to develop a sustainable and diversified agricultural sector that boosts income generation, and food and nutrition security. MOA's mandate is derived from the Government Gazette Notice No. 836 of 2016. Its kay functions are: Agricultural Credit, Agricultural Development Agricultural Marketing Policy, Agricultural Research and Specialist Services, Agricultural Training, Agricultural Policy, Agriculture Extension Field Services, Food Security, Irrigation Development, and Seeds, Standards and Grades.

The Ministry is responsible for the following statutory bodies and institutions:

- Agriculture Colleges and Training Institutions
- Cotton Board of Zambia
- Food Reserve Agency
- Natural Resources Development College
- Nitrogen Chemicals of Zambia
- Seed Control and Certification Institute
- Tobacco Board of Zambia
- Warehouse Licensing Authority
- Zambia Agricultural Research Institute
- Coffee Board of Zambia

The MOA is supported by the following departments: Department of Agricultural, Agri-business and marketing, seed control and Certification Institute, Human Resource Administration, Finance, Agricultural Research Institute, Policy and Planning, Plant Quarantine and Phytosanitary Service, and National Agricultural Information Services (NAIS).

Department of Agriculture: It is the primary provider of extension agricultural service to enable the farmers make informed decisions so as to increase their production and productivity. It is divided into departmental units including Technical Services Branch, Crops Production Agricultural Advisory Service and Food and Nutrition. The Department is responsible for provision

[27] Ministry of Agriculture – MOA

of extension, advisory and technical services to farmers on various aspects of crop production, irrigation development, agricultural mechanisation and land husbandry. The main functions of the Department include:-

- Disseminating technical and other information to the farming community;
- Providing technical services in irrigation, farm power, mechanisation and land husbandry;
- Providing technical information in crop production, horticultural production, nutrition, crop protection and soil fertility.

Seed Control and Certification Institute (SCCI): It is a government authority responsible for seed regulation and certification. The authority is responsible for implementing, registering, and enforcing Plant Breeders' Rights in Zambia, governed by Zambia's Plant Breeders' Rights Act No. 18 of 2007. SCCI is the seed certification authority in the country and is accredited to the International Seed Testing Association (ISTA).

### 8.2.4 Emerging Regulation

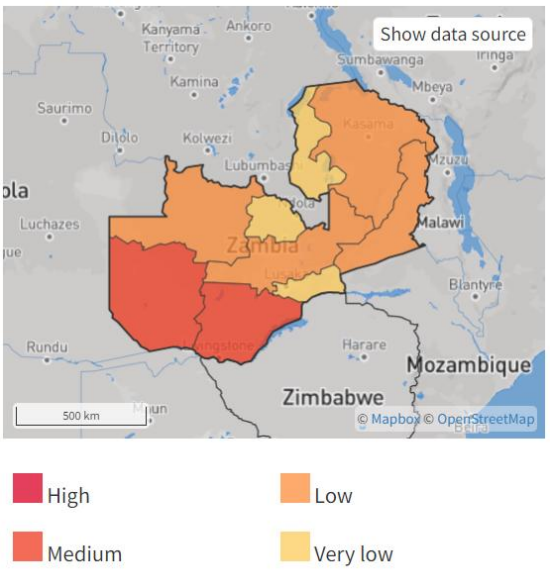
Animal Identification and Traceability Act, 2024: The Act was enacted on 16th April 2024. The Act establishes the Animal Identification and Traceability Unit and provides for its function. Provisions established under the Act are animal identification and traceability system, registration of animal identification marks and agents; and traceability of animals, animal products and animal by-products. This Act repeals and replaces the Animal Identification Act, 2010.

Environmental Management (Amendment) Act, 2023: This is an Act to amend the Environmetal Management Act, 2011. The Act was enacted on 17th August 2023. The purpose of the amendments is to revise the functions of the Zambia Environmental Management Agency; provide for the registration of pesticides or toxic substances and revise the provision on summary imposition of penalties; harmonise the provisions relating to solid waste management with the Solid Waste Regulation and Management Act No. 20 of 2018; and to domesticate the Kigali Amendment to the Montreal Protocol on substances that deplete the ozone layer.

## 8.3 ENVIRONMENTAL RISKS ANALYSIS

### 8.3.1 Water availability

According to ThinkHazard!, water scarcity in Zambia is classified as medium. This means that there is up to 20% chance droughts will occur in the coming 10 years. Due to climate change, Zambia's water availability is expected to decrease by about 13% by the end of the century. Temperature rise in Zambia is projected to reach 1.9°C by 2050 and 2.3°C by 2100. Precipitation is projected to decrease by about 3% by mid-century. Towards the end of the century, the country as a whole will only experience a decline of about 0.6%. However, there are significant regional differences, with the southern, western and eastern regions expected to be more affected than the northern region.




*Source: ThinkHazard!*
*Figure 8-6 Water scarcity*

These findings have implications for smallholder irrigation development in Zambia. First, it means that to reduce costs, current and future irrigation systems will need to use more water-efficient technologies, such as overhead irrigation systems (e.g., recirculating and drip irrigation), instead of the prevalent surface irrigation methods. Second, reduced water availability will increase the costs of access and irrigation, which may in turn reduce profitability for smallholder farmers, who generally have limited capital and capacity to adapt to high-cost structures. Third, competition for fewer available water resources will disadvantage smallholder farmers; political measures are needed to protect them from large consumers. Opportunities need to be explored to transfer large volumes of water from areas of low water demand and high-water levels in the north to areas of high-water demand and low water levels in the south. Fourth, water resources management and regulation need to be strengthened, including by making water user rights and fees binding for smallholder farmers. In addition, rainwater collection and storage need to be improved by investing in more efficient reservoirs. Further consideration is needed on how these reservoirs should be managed to ensure equitable access to water resources and reduce water losses through evapotranspiration (Ngoma, 2019).

Water availability is critical for crops such as maize and soybean. Maize is a staple crop and is highly sensitive to water stress. Lack of water during critical growth periods can result in significant yield losses (Branka Kresović, 2017). Soybean is particularly affected by water deficit during the grain filling stage, resulting in lower yields and poor quality (Guilherme Felisberto, 2023).

### 8.3.2 Land Degradation and Soil Erosion

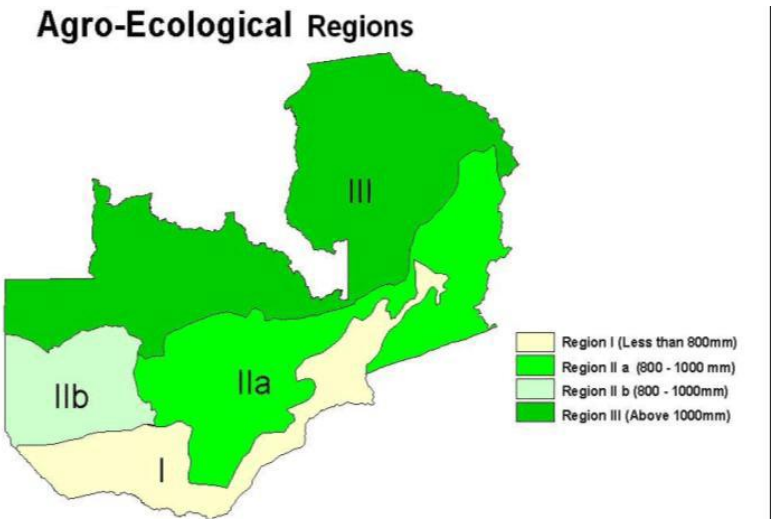
Soil erosion and land degradation are significant environmental issues in Zambia, affecting agriculture, biodiversity and the entire ecosystem. Soil erosion in Zambia is primarily caused by human activities such as deforestation, mining and unsustainable agricultural practices (Sambo, 2019). These activities lead to loss of vegetation, soil fertility and biodiversity. This results in reduced agricultural productivity, increased poverty and increased vulnerability to climate change (EU: intractive country fishes , 2024). Soil erosion is the main driver of land degradation in Zambia. Factors such as overgrazing, deforestation and poor land management further exacerbate the situation. Soil erosion causes loss of the topsoil layer, which is important for crop production. This leads to lower crop yields and increased food insecurity. Moreover, depletion of soil nutrients and loss of arable land makes it difficult for farmers to sustain their livelihoods, exacerbating rural poverty and food insecurity (Sentinel, 2022).

Maize and soybeans are particularly vulnerable to the effects of land degradation and soil erosion, which strip away the nutrient-rich topsoil. This depletion of fertile soil hampers the ability of crops like maize and soybeans to access essential nutrients, leading to reduced soil fertility. Consequently, the productivity of these crops declines (EGBETOKUN O.A., 2014). Additionally, degraded soils often have poor water retention capacity, resulting in increased water stress for crops. This is especially harmful during the critical growth stages of maize and soybeans.

### 8.3.3 Soil Fertility and Acidification

Zambia's soils are generally not very fertile, which affects crop yields. The country is divided into three main agro-ecological regions with different soil types and fertility levels (Stalin, 2004).

- **Region I:** (Luangwa and Zambezi rift valley areas covering 14% of the land area) This region has soils that are prone to erosion and low fertility and is often affected by frequent droughts and floods.
- **Region II:** (Central and Eastern plateaus of Zambia comprising 28% of the land area) This region is highly productive, and the soils are suitable for agriculture; however, it still faces challenges such as low nutrient reserves and low water storage capacity.
- **Region III:** (Semi-arid plains of Western Province comprising 12% of the land area) This region has highly degraded and acidic soils with relatively low fertility (FAO, 2012).




*Source: Lower Zambezi.*

*Figure 8-7 Zambia - Agro-ecological zones*

Soil acidification is a widespread problem, especially in areas where smallholder farmers predominate. Acidic soils can limit the availability of important nutrients to plants and reduce crop productivity. The main causes of soil acidification in Zambia are:

- **Monoculture:** Repeated cultivation of the same crop on the same land causes soil nutrients to be lost.
- **Use of certain fertilizers:** Some fertilizers can increase soil acidity over time.
- **Leaching:** In some areas, high rainfall causes leaching of basic nutrients, making soils more acidic (Meki Chirwa, 2016).

When soil become more acidic (pH values decrease), the availability of important nutrients such as phosphorus decrease (Cornell University, 2005). This can limit maize and soybean growth and development. Increased soil acidity can lead to higher concentrations of toxic elements such as aluminium, which can inhibit root growth and reduce nutrient uptake in both maize and soybeans. Soil acidity can also reduce the efficiency of nitrogen use in maize, resulting in lower nitrogen uptake and reduced crop yields (Xiaoying Pan, 2020).

### 8.3.4 Pesticides use

Several studies have looked at the types of pesticides used by Zambian farmers. The common key findings state that Zambian farmers lack training in personal protective equipment, the correct use and dosage of pesticides, and waste management (Joseph Goeb, 2021). Other studies revealed the types of pesticides used by farmers. And while most of them are type II and III according to WHO classification (more than 40% of small farmers use glyphosate, also known as Cycat, Roundup, Gryfona, Glyfocure, Buccaneer, Muscle Up, Eraser, Extreme, Ranger Pro and Baza trades. 32% reported using dicamba (Stella Star) and 25% reported using paraquat marketed as Paraquat, Parachute and Gramoxone. Researchers also found two active ingredients that are Class Ib, (Monocrotophos: Used by 14% and Methamidophos that is less commonly used). These two active ingredients are used for maize, soybeans, cotton, tomato and other crops, and can be highly hazardous when used beyond their controlled dosage (The Conversation, 2020). In the case of Zambia, the use of these chemicals poses significant health and environmental risks, especially given the lack of formal training among many farmers on safe pesticide handling and application (Mutinta J. Malambo, 2019).

### 8.3.5 Deforestation

Deforestation is a major problem in Zambia. The country loses an estimated 250,000 to 300,000 hectares of forest each year. This is about 0.8% of the country's forests per year (VCA, 2024). The main causes of deforestation are:

- Agricultural expansion: Many communities cut down forests to create farmland.
- Charcoal production: Charcoal is an important source of energy, which leads to large-scale logging.
- Forest fires: Uncontrollable fires contribute to forest loss.
- Timber production: Timber production also plays a role (Zambia, 2021).

### 8.3.6 Genetically Modified Crops

Genetically modified (GM) crops are controversial in Zambia (Zambia Alliance for Agroecology and Biodiversity, 2022). The country has a tough stance against the cultivation of genetically modified crops such as maize and soybean (ITA, 2024). This policy is rooted in concerns about potential health risks, environmental impacts, and economic consequences for smallholder farmers.

In 2002, Zambia rejected food aid in the form of GM maize during a severe drought, citing caution about immediate aid. This decision shaped the country's ongoing resistance to GM crops. Although Zambia allows the importation of genetically modified

foods, the cultivation of genetically modified crops is still prohibited in the country. Recently, the National Biosecurity Authority (NBA) seized more than 2,000 tonnes of genetically modified maize seeds in several provinces, reinforcing strict restrictions on the cultivation of genetically modified plants (LusakaTimes, 2021).

## 8.4 SOCIAL RISKS ANALYSIS

### 8.4.1 Labour and Working Conditions

Risks associated with Smallholder farming: Small-scale farming in Zambia is crucial for rural employment, food security and economic stability, significantly contributing to the country's gross domestic products. Zambian smallholder farmers face several challenges that hinder their productivity and sustainability. Key issues include delays in receiving essential inputs such as fertilizers, seeds, chemicals, and extension services. Additionally, the reliance on rainfed agriculture makes them vulnerable to erratic weather patterns, including droughts and floods, which severely damage their crops. Small-scale farmers often possess limited knowledge and skill, relying on traditional farming methods that primarily focus on subsistence and selling surplus (Moonga & Qutieshat, 2023). In the agricultural sector, many farmers are engaged on a temporary, seasonal or part-time basis. Many of these farmers employed in the informal sector lack written contracts that often leads to job insecurity and limited access to employment benefits (Ministry of Labour and Social Security, 2014).

Unions for Rice and Soybeans: Trade Unions in Zambia face significant challenges due to the pressures of open and expansive unionism, including inter-union conflicts and limited resources for organizing. Non-unionized rice and soybeans farmers in Zambia face several distinct challenges including lack of support and collective bargaining of unions. The farmers struggle with limited access to essential resources such as seeds, fertilizers and technical advice.

Migrant workers: Zambia's 2010 national census recorded 43,867 immigrants, making up 0.4% of the population, with males constituting 53% and females 47%. The main nationalities of the immigrants included those from the Democratic Republic of Congo, Angola, Zimbabwe, India, Rwanda and Tanzania. During the same period, the department of immigration issued 101.792 permits, predominantly employment permits (49.4%) and temporary employment permits (19.4%). Conversely, Zambian emigration data indicated that 278,355 Zambians left the country, representing 1.6% of the projected 2018 population. Major destinations for migrants included South Africa, Malawi, United Kingdom, United states and Botswana. 2010 national census also reviewed that 16.8% of Zambians were living in districts from their birthplace reflecting significant internal migration across administrative boundaries. Urban-to-urban migration was the most common form of internal movement, accounting for 38.7% of this migration. The Constitution of Zambia (Amendment) Act No. 2 of 2016 outlines the process by which a non-citizen can acquire Zambian Citizenship including an introduction of a dual citizenship clause. Main factors that contribute to internal migration are extreme weather events such as floods and Persistent droughts, land disputes, development projects, encroachment on land designated for other uses and conflicts in border areas. International migration is fuelled by the following number of factors including poor living conditions, unemployment, political instability, among others (IOM, 2019). Migrant workers in Zambia, particularly in the agricultural sector are faced with many problems including poor job satisfaction, insecurity and low wages. Many workers work in conditions that fails to meet the basic labour standards such as minimum wage and social security contributions.

Occupational Health and safety: Zambian agricultural workers are exposed to a broad range of occupational health hazards. Data on Occupational Health and Safety in the agricultural sector in Zambia is limited, leading to incomplete understanding of the negative impacts of poor working conditions. Workers working in agriculture are exposed to occupational hazards such as strenuous work, sharp tools and pesticides. Arduous physical work without enough recovery time, results in musculoskeletal disorders such as pain in the lower back, hands, shoulders and legs.

### 8.4.2 Child Labour

Zambia has ratified both ILO conventions 138 on Minimum Age to Employment and 182 on the Elimination of the Worst Forms of Child Labour. The national law prohibits the employment of children in any commercial, agricultural or domestic work, including the worst forms of child labour. The minimum age for employment is set at 15, with 18 being the minimum age for hazardous work. The Zambia Employment of Young Persons and Children Act (No. 1 of 2004) stipulates that no young person shall be employed in any type of hazardous work. The enforcement of the Zambian Laws is weak leading to inadequate protection of young workers.

Despite these regulations, Child labour is prevalent in various sectors in Zambia, including subsistence agriculture, prostitution and mining. The agricultural sector, in particular, accounts for 85% of child labour cases, frequently with consent of families. However, there is no conclusive data to verify child labour cases in the rice and soybeans production.

Separated from their families or unaccompanied migrant children faces increased risk of violence, exploitation and trafficking. Zambia has made progress in addressing worst forms of child labour. The government revised the Trafficking in Persons Act to remove the need to prove force, fraud or coercion for establishing child trafficking offenses. Additionally, Zambia introduced the National Human Trafficking and Smuggling of Migrants Policy and the National Migrant Policy, both outlines' strategies to safeguard Zambia and Migrant Children from trafficking and labour exploitation.

### 8.4.3 Forced Labour

Forced labour is prohibited under the Constitution, Anti Human Trafficking Act 2008 and Penal Code. The Anti Human Trafficking Act defines forced labour as a labour or services obtained or maintained through threats, the use of force, intimidation or other forms of coercion or physical restraint. Penalties for trafficking- related offences in Zambia range from 25 to 35 years imprisonment. Zambia has also ratified the Abolition of Forced Labour Convention 1957 (No.105) and Forced Labour Convention 1930 (No. 29)

Traffickers exploit women and children from rural areas in Zambia and neighbouring countries, subjecting them to various forms of forced labour and abuse. These individuals are trafficked to cities and foreign countries for domestic servitude, agricultural work, textile production, mining, construction, street vending and forced begging[28].

### 8.4.4 Access to Land and Land Tenure

All land in Zambia is vested in the president as provided for by the Constitution. The legal framework governing land tenure is Land Act 1995. Zambia has a dual land tenure system, namely customary and State land. Customary land is administered by the chiefs according to the customary laws and norms applicable to different jurisdictions and subject to Zambian laws. The Urban and regional Planning Act, 2015, was enacted with provisions for development, physical planning and administration for both state and customary land. Lands (Customary Tenure) (Conversion) Regulations (Cap.184) prescribes the procedure on conversion of customary land tenure into leasehold tenure.

Approximately 94% of the country is covered by customary land. There is lack of transparency, communication and coordination between traditional leaders and government regarding land rights at the interface of state and customary land is a major source of tenure insecurity on both customary and unplanned state land. Conversion of customary land to leasehold

[28] Zambia - United States Department of State

tenure is creating real and perceived tenure insecurity for smallholder farmers because once land is transferred to leasehold tenure, it can never revert back to customary control. Rural areas have natural resources, which results in competing interests over land between incoming investors and rural communities (USAID, 2017).

### 8.4.5 Community Health and safety

Agriculture has profound implications on the broader community health and safety. This includes use of pesticides and herbicides that poses significant risks to farm workers and local communities through potential chemical exposure which can result in health issues ranging from acute poisoning to chronic diseases. Additionally, agricultural runoff can contaminate water resources, affecting both water quality and aquatic ecosystems that are support communities. Agricultural practices can influence the spread of vector-borne diseases such as those carried by mosquitoes, by altering habitats and water management practices.

## 8.5 GENERAL E&S RISK CONSIDERATIONS IN FL-RS INTERVENTION IMPLEMENTATION

**Land Degradation and Soil Erosion:** With soil erosion being a major driver of land degradation in Zambia, FL-RS interventions like the use of hermetic bags and improved storage solutions can help reduce the need for expanding agricultural land, thereby mitigating further soil erosion. Training programs should emphasize sustainable land management practices, which can protect topsoil and enhance the productivity of existing farmlands, particularly for erosion-sensitive crops like maize and soybeans.

**Soil Fertility and Acidification:** The low fertility and high acidity of Zambian soils are significant challenges for crop productivity. The adoption of FL-RS technologies, such as hermetic storage and improved post-harvest practices, can help maintain crop quality and reduce the pressure on farmers to overuse chemical fertilizers that contribute to soil acidification. Training on the balanced use of fertilizers and crop rotation practices should be included to improve soil health and enhance the effectiveness of these interventions.

**Pesticide Use**: The heavy reliance on hazardous pesticides in Zambia poses serious health and environmental risks. FL-RS interventions should focus on promoting the use of biological control agents and safer pesticide alternatives, alongside hermetic storage solutions that reduce the need for chemical treatments. Providing comprehensive training on the correct use and disposal of pesticides will be crucial to mitigate these risks and ensure safe farming practices.

**Labour and Working Conditions:** The introduction of FL-RS technologies, like mechanical threshers and shellers, can significantly reduce the labour burden on smallholder farmers and improve working conditions. However, these technologies must be accessible to all farmers, including those with limited resources. Training on the safe and effective use of these technologies, along with ensuring fair labour practices, will be essential to improving the livelihoods of smallholder farmers.

**Child Labour:** FL-RS technologies have the potential to reduce the reliance on child labour by decreasing the manual labour required for post-harvest activities. However, it is important to monitor the deployment of these technologies to ensure they do not inadvertently increase the workload for children in other areas, such as equipment operation or post-harvest handling. Training programs should include components on child labour awareness and prevention to safeguard children's rights.

**Forced Labour:** By enhancing agricultural productivity and efficiency, FL-RS interventions can help reduce the economic pressures that contribute to forced labour. Ensuring that these technologies are implemented alongside robust labour rights protections and community support mechanisms will be critical in preventing exploitation, particularly in vulnerable populations.

**Access to Land and Land Tenure:** Zambia's dual land tenure system presents challenges for the equitable deployment of FL-RS technologies. Ensuring that these interventions are accessible to all farmers, including those on customary land, is crucial. Training and capacity-building efforts should address land rights issues, helping smallholder farmers secure their tenure and protect their livelihoods from land-related conflicts.

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