

An aerial photograph of a vast, lush green mountain valley in Ethiopia. The terrain is characterized by steep, terraced slopes covered in vibrant green vegetation, likely crops or pastures. In the lower-left corner, a small cluster of traditional, round-roofed dwellings is visible. The background shows more rugged, forested mountain peaks under a clear sky. A semi-transparent white box is overlaid on the upper portion of the image, containing the title and subtitle.

ETHIOPIA

A CASE STUDY CONDUCTED BY THE CLIMATE
RESILIENT FOOD SYSTEMS ALLIANCE

OCTOBER 2022

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1. Geography and Economy

Ethiopia is a landlocked country in the Horn of Africa, bordering Eritrea to the north, Djibouti and Somalia to the east, South Sudan, and Sudan to the west, and Kenya to the south. The country is vast, covering a territory of 1.1 million km², which creates challenges for territorial governance.

Ethiopia's topography is characterized by large regional differences, which are reflected in its climate. Ethiopia's equatorial rainforests in the south and southwest are characterized by high rainfall and humidity, while the Afro-Alpine on the summits of the Semien and Bale mountains, and the north-east, east and south-east lowlands experiencing desert-like conditions. The lowlands in the southeast, covering approximately 55% of the country's land area and northeast are tropical with average temperatures of 25-30°C, while the central highlands (over 1500 meters in elevation, covering about 45% of the country's surface) are much cooler with average temperatures around 15-20°C (Government of Ethiopia, 2021).

Ethiopia has three rainfall seasons: Bega, Belg, and Kiremt. The primary rainy season, Kiremt, occurs from mid-June to mid-September and accounts for 50–80% of annual rainfall. Parts of central and northern Ethiopia experience a sporadic, secondary wet-season, Belg, which often has considerably less rainfall and occurs from February to May. Southern regions of Ethiopia experience two distinct wet seasons, Belg, from February to May, and Bega occurring from October to December, which has drier and colder conditions. Mean annual rainfall ranges from less than 300 mm in the south-eastern and northwestern lowlands to over 2,000 mm in the southwestern highlands (World Bank, 2021).

Overall population: 117,876,000 (2021)

Economy: Agriculture accounts for 40-50% of the total GDP

Food systems vision: holistic transformation of Ethiopia's food systems from production to consumption that promotes enhanced food safety, nutrition and diets, improved livelihoods, greater land preservation and restoration and greater resilience to shocks and stress.



Historical data from weather stations for Ethiopia shows that the mean annual temperature for Ethiopia has increased by an average of 1 °C since 1960, at an average of 0.25 °C per decade. Based on the climate change profile of Ethiopia, under a high emissions scenario, the country is projected to face increasing average temperatures of 1.8 °C by 2050, and 5.2 °C by 2100 (World Bank, 2021). These climate changes will cause increased uncertainty and variability in seasons and rainfall as well as increased extreme events in the country. The lowland is predicted to suffer most with prolonged droughts and increasing temperatures affecting agro-pastoral production systems in the region. The highland on the other hand is predicted to suffer from extreme events such as dry spells coupled with irregular and intense rainfall.

With about 118 million people (2021), Ethiopia is the second most populous nation in Africa after Nigeria, and the fastest growing economy in the region (World Bank, 2021). Ethiopia's population is young and growing rapidly, having increased by 35 million between 2000 and 2016 (Minten, Dereje, Bachewe, & Tamru, 2018). Rapid population growth is putting pressure on land availability in rural areas - particularly in the densely populated highlands. With little room for agricultural expansion in these regions, plot sizes are decreasing, and growing numbers of Ethiopia's rural youth are becoming landless and reliant on land rental markets (Minten, Dereje, Bachewe, & Tamru, 2018).

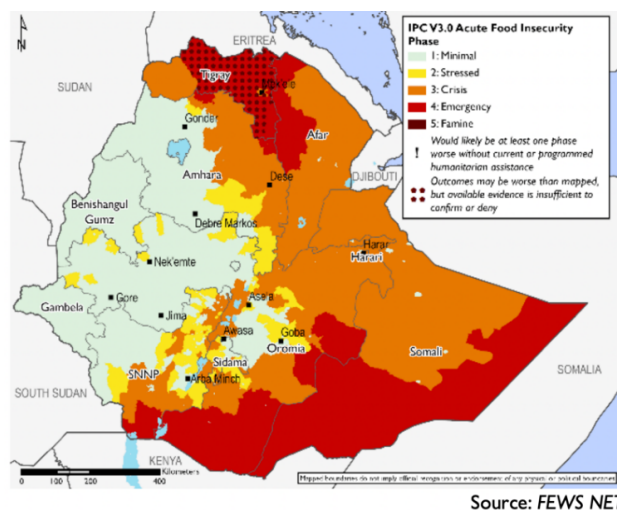
In 2020, Ethiopia was the 59th strongest economy in the world in terms of GDP, the 127th in total exports, 92nd in total imports, 173rd economy in terms of GDP per capita and the number 97 most complex economy according to the Economic Complexity Index (ECI). The top exports of Ethiopia are coffee, oily seeds, gas turbines, vegetables, and gold, exporting mostly to United States, Somalia, Hong Kong, United Arab Emirates, and Saudi Arabia. The top imports of Ethiopia are refined petroleum, gas turbines, planes, helicopters, and/or spacecraft, wheat, and packaged medicaments, importing mostly from China, India, United Arab Emirates, United States, and Kuwait (OEC, 2020). Agriculture and livestock alone account for more than a third of GDP (FAO & ECDPM, 2021).

The rapid economic growth in the last two decades was primarily driven by government investments in agriculture, infrastructure, and rural services. The smallholder farming system which accounts for about 90% of the cropland area in the country, is the backbone of the economy and people's livelihood. This farming system is mostly reliant on **rainfed agriculture**, and as such it is extremely vulnerable to climate variability and climate change.

The varying climatic conditions coupled by political and economic shocks in the country have fueled chronic malnutrition, extreme poverty, rapidly growing and young unemployed urban populations, limiting the country's ability to provide for itself. According to FAO statics, 25% of Ethiopia's population suffers from undernourishment, while 19.6% dwells in a situation of severe food insecurity (FAOSTAT, 2022).

The severity of food insecurity in Ethiopia is amongst the worst globally, driven by the climate impacts mentioned and ongoing conflict. The problem is felt throughout the country as evidenced by the minimal pasture and water availability in the country. This year, across much of central and eastern Ethiopia, the rains fell for only a few days and totaled less than 50 percent of average.

Ethiopia also faces increasing GHG emissions from livestock production. Livestock production already contributes about 40 percent of total emissions and the potential GHG emissions from the sector are projected to increase by 5.8% per year, compared to the 0.2% on average for the world, and 1.2% for the rest of Africa (IISD, 2022).



Despite several challenges, the Ethiopian government's vision is to become a lower middle-income country by 2025 mainly to be driven by agriculture (Federal Democratic Republic of Ethiopia, 2016).

2. Ethiopia's Food systems

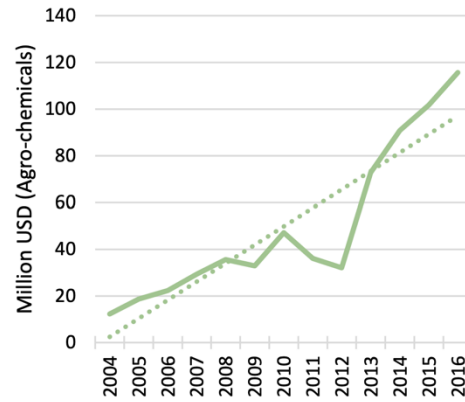
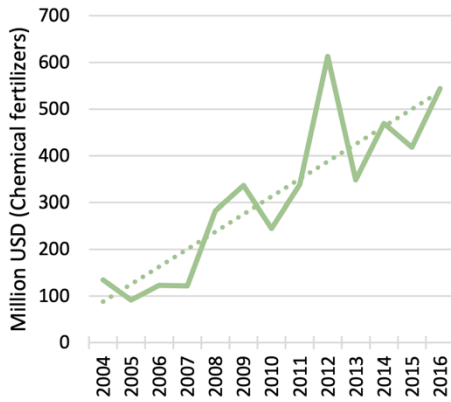
Ethiopia has made significant strides in developing their food systems, especially in the last two decades. The rapid population growth and increasing urbanisation, growing incomes and investments in infrastructure in the last few years have led Ethiopia's food system to evolve from a 'traditional system' characterized by subsistence farming, low levels of urbanisation and localised value chains, to a 'transitional system' characterized by longer value chains, the increased importance of markets, growing urban demand and emerging quality standards (FAO & ECDPM, 2021).

To transform Ethiopia's food system, significant challenges need to be addressed- from consumption to production to distribution. Growing population and rising incomes will increase demand for nutritious foods, leading to the need for arable land. Furthermore, the ongoing impacts due to climate change and environment degradation that have increased soil erosion and land degradation should also be addressed. Production needs to be diversified to reduce monocropping and to increase food choices and the availability of affordable nutrient-dense foods. Livestock production needs to be expanded to improve access to nutritious animal-sourced foods without leading to significant increases in greenhouse gas emissions. The growing food systems sector also needs to be supported to drive job creation and increase access to healthy and nutritious foods (Government of Ethiopia, 2021).

2.1 Production

About 12 million smallholder farmers produce about 95% of all agricultural production. With a total area of about 51.3 M ha of arable land, Ethiopia has a huge potential for agricultural development. With diverse agroclimatic conditions in place, Ethiopia can grow a large variety of crops, including cereals like teff, wheat, maize and barley and pulses like field peas, lentils, chickpeas, and other different types of fruits and vegetables (FAO & ECDPM, 2021). In the hot and dry lowlands in the eastern part of Ethiopia, crop production is limited and the main agricultural activity is livestock rearing. The highlands, meanwhile, provide ideal conditions for producing cereals. Four of Ethiopia's regions are identified as having significant agricultural potential: Amhara, Oromia, Tigray and Southern Nations, Nationalities and Peoples Region (FAO & ECDPM, 2021). Despite the significant potential for diverse crops, only 11.7 M ha of land is currently cultivated – cereals dominating 70% of the agriculture variety.

Agricultural production in Ethiopia has grown rapidly due to the expansion of cultivated land and the intensification and modernisation of agriculture. The intensification and modernization in agriculture have been driven by expanded availability of agricultural extension agents, improved market access, better price incentives and higher education levels of farmers (Minten, Dereje, Bachewe, & Tamru, 2018). The figure below shows how the imports of chemical fertilizers have more than quadrupled from 2004 to 2016:



Source: UN, Comtrade, <https://comtrade.un.org/data/>. Note that dotted line is linear trend over the period examined.

1. Cereals

According to the National Food Systems Pathway of Ethiopia, the total cereal production in the country increased by 2.7 times and the yield of other crops have also significantly increased, driving production increases. The total area under cereal cultivation grew by 1.34% p.a and total production has grown by 5.4% p.a. and cereal productivity by 4% p.a. since 2000 (Government of Ethiopia, 2021).

Maize accounts for 32.5% of total cereal and 21.7% of total area under cereal, followed by wheat 17.9% of cereal production and 17.1% area, sorghu m 17.4% of total cereal production and 17% of area, teff 19.3% of cereal production and 29.6% of total area, barley accounts for 8% of total production and 9.1% of area, finger millet 3.8% of production and 4.3% of area, and oats 0.2% of production and 0.2% of area (Government of Ethiopia, 2021).

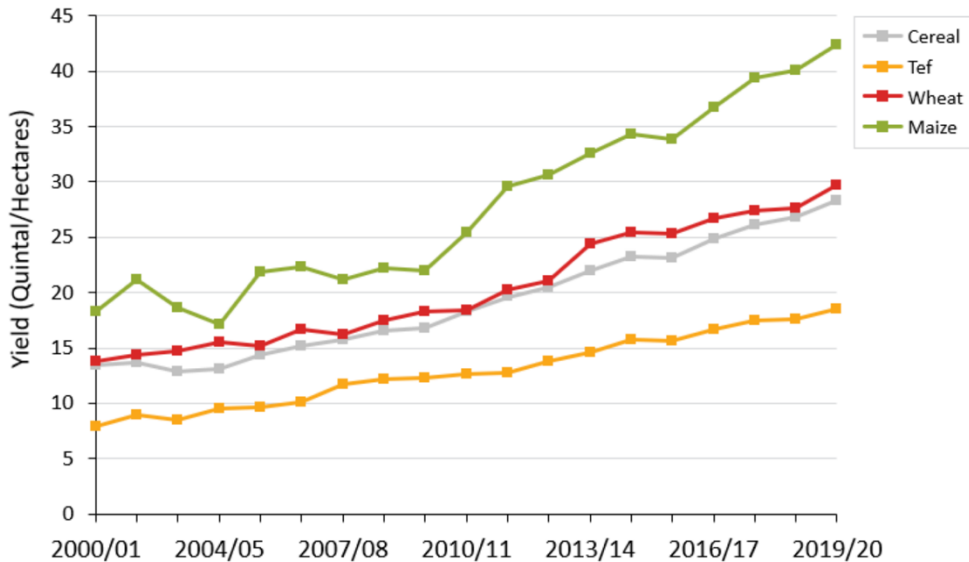


Figure 1: Cereal crop yield - 2000 to 2020. Source: Government of Ethiopia, 2021

2. Pulses and oil seeds

Because of Ethiopia's diverse agroecological zones, the country is able to produce a wide variety of pulse crops and is the world's biggest exporters of pulses. Ethiopia is the world's second largest producer of fava beans and sixth largest producer of chickpeas (FAO & ECDPM, 2021). Major markets for Ethiopia's pulses exports include Pakistan, Vietnam, Indonesia, the United Arab Emirates (UAE) and its neighbours, Kenya and Sudan (FAO & ECDPM, 2021). Only 14 percent of local pulses production in Ethiopia get exported and the rest is consumed locally as food, feed, or seeds (USDA, 2014). Pulse crops account for 12 percent of Ethiopia's crop production and occupy about 12 percent of Ethiopia's cropland, with fava beans accounting for almost a third of the production.

The potential for the pulses production in Ethiopia has not yet been fully exploited, but there is a growing demand locally and internationally for more pulses. Particularly, pulses like haricot beans, chickpeas, red kidney beans and mung beans are proven to have favorable conditions of production in the country. Other beans like mung beans are emerging crop in the country, offering a potential for production.

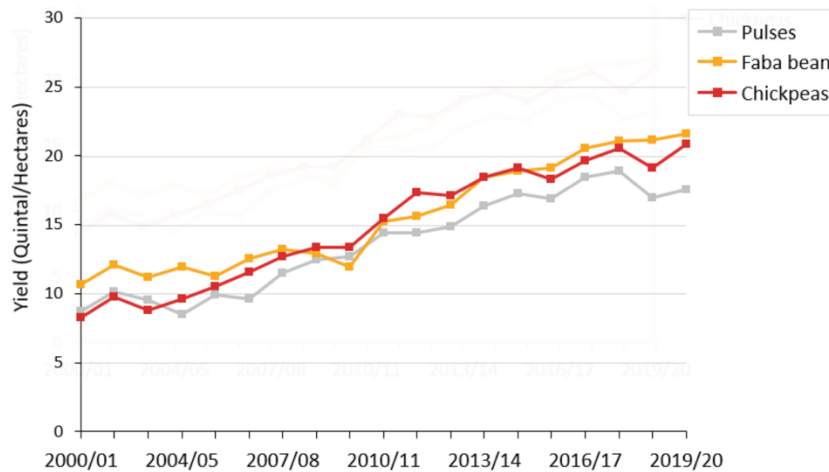


Figure 2: Pulse crop yield. Source: Government of Ethiopia, 2021

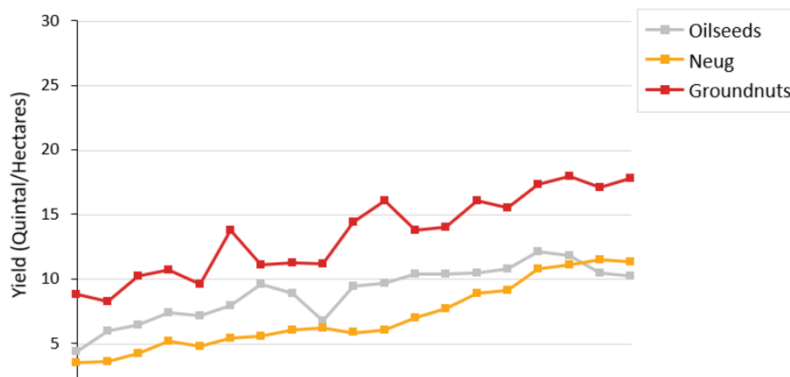


Figure 3: Oilseeds yield. Source: Government of Ethiopia, 2021

Oil seeds also constitute as one of the most important staple foods in Ethiopia. Its production has been growing at a rate of 6.6% over the past two decades (Government of Ethiopia, 2021)

3. Dairy and livestock

Dairy and livestock play an important role in national development in Ethiopia. This sector accounts for at least 40% of Ethiopia's agricultural GDP. Ethiopia has one of the largest livestock populations in Africa – about 60 million, which enables Ethiopia to produce nearly 3 billion litres of milk a year (ILRI, 2018). Ethiopia's temperate climate enables the country to have a huge potential for dairy development.

Ethiopia has seen a steady increase in demand for dairy products recently. Between 2007 and 2017 the number of dairy processors in Ethiopia increased from 8 to 25 and annual overall dairy production has increased from 927 million liters in 1996 to 3.3 billion liters in 2018 (Tschopp, Gizachew, & Wood, 2021). Most milk production comes from smallholder farmers in rural areas who pool their milk through dairy cooperatives organised under dairy unions (GAIN, 2021).

4. Other crops

Ethiopia is the largest producer of coffee, and it is a source of livelihood to 15 million Ethiopians (Climate Adaptation Platform, 2021). An estimated 525,000 hectares of coffee are planted in Ethiopia (Kew; ECFE, 2017). The country is the main storehouse of genetic diversity for Arabica coffee and is produced within specific agro-ecological zones over numerous political divisions. The main coffee growing areas are found within Oromia Region and Southern Nations, Nationalities, and Peoples' Region (SNNPR), with modest production in Amhara Region and minor output in Benishangul-Gumuz Region. Other primary crops that Ethiopia produce include spices, herbs, sugarcane and potatoes.

Although the country has been producing a rich variety of crops, food security remains a critical issue as agriculture sector remains fragile and vulnerable to climate change, affecting agriculture and food systems in the country (Ogola, 2021). The climate variability problem affect crop and livestock outputs as most Ethiopians rely on agriculture and pastoralism for their livelihoods, all which are heavily dependent on rainfall. Poor land management practices (overgrazing, deforestation, inadequate landuse planning) that lead to land degradation has contributed to high rates of soil nutrient depletion.

The productivity of agriculture and livestock is low also due to a range of factors including low feed availability, limited access to health services for livestock, limited access by smallholders to agricultural inputs, financial services, production technologies and irrigation markets.

2.2 Consumption

Ethiopia has seen a dietary transformation in recent times with higher consumption levels. The relative share of cereals in food baskets are declining and the high-value products like animal-source foods and fruits and vegetables are rising. There is also a growing trend of processed and convenience foods in markets, and greater out-of-home consumption (Minten, Dereje, Bachewe, & Tamru, 2018).

Ethiopians are consuming more. The total annual food consumption in Ethiopia has increased from 288 kg per year in 1996 to 447 kg in 2018. With increased consumption, national rates of hunger have fallen from 56% to 29% between 2000 and 2019 and the percentage of children who

are chronically undernourished (with insufficient dietary energy) has declined from 58% to 37%. Such progress has resulted in lower mortality rates and improved life chances for millions of families and their children (Government of Ethiopia, 2021).

Healthy diets are increasingly becoming an issue in Ethiopia. Ethiopians, particularly in urban areas, are eating more processed and convenience foods, including meat and wheat-derived products, and eating outside of the home more often, developments typically seen as incomes rise (Minten, Dereje, Bachewe, & Tamru, 2018). Household consumption also remains dominated by starchy staples like cereals and pulses, especially among the rural poor. The prices of nutrient-rich foods have increased with the growing demand, limiting the accessibility of such foods for the poor households.

Lack of diversity in diets and underconsumption of nutrient-rich fruits and vegetables have contributed to high levels of malnutrition in the country. For example, despite the growth in dairy production, milk is rarely consumed in Ethiopia. The average milk consumption in the country is about 20 liters per capita per year, much lower than WHO's recommended consumption of 205 liters (GAIN, 2021). This has been low due to lack of affordability and availability - low incomes are a key constraint to dairy consumption, and most consumers cannot afford to buy dairy in recommended quantities. The low levels of dietary diversity is caused by the limited purchasing power of consumers. One in four (24.8 %) households in Ethiopia fall below the food poverty line and 25.5% of individuals are food insecure.

Consequently, starchy staples that are the cheapest source of energy contribute the highest share of the energy intake (71.4 %) (Government of Ethiopia, 2021). The rising incomes in the country is likely to drive transformation in Ethiopian food system and lead the population to shift to more varied and nutritious diets. These ongoing transformations in consumption are having, and will continue to have, significant impacts on the socioeconomic, food security and nutrition and environmental outcomes generated by the Ethiopian food system.

2.3 Distribution

The food supply chain is transforming in Ethiopia with more reliance on markets by consumers and better integrated markets. There is a greater development of commercial food markets and modern food distribution and retail infrastructure. Ethiopia is witnessing the emergence of modern food marketing methods, technologies and systems, reflected in the increased use of mobile phones, the establishment of a commodity exchange, a growing (but still small) modern food service sector and increasing differentiation in food retail markets.

Food Systems transformation has also driven tangible economic benefits. Average farmer incomes have risen significantly, driven by an increase in the real value of agricultural commercial surplus, which has doubled over the last decade, from 8 billion to 16 billion Birr.

Private sector agricultural investment has increased significantly in the last decade, with formal agribusiness' share of GDP growing from 5% in 2012 to 13% in 2018.

Ethiopia's emerging dairy value chains display significant commercial potential due to increasing local demand for dairy products, current supply gaps and potential for improved yields. There is also strong government backing for promoting the dairy subsector, and Ethiopia's agro-industrial parks present opportunities for investing in dairy processing.

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There is also significant commercial opportunity for investment in Ethiopia's pulses value chains, in production (especially for export), contract farming, input supply, processing and trading

Fruit and vegetable value chains are also promising. Growing local demand for fruits and vegetables means high prices on the local market, and there is significant export potential for products such as avocados, as well as underutilised irrigation potential and abundant cheap labour.

2.4 Key challenges for the Ethiopian food system

Despite the rapid progress made in Ethiopia's food systems in the past two decades, there are also many challenges that exist. During the period 1991-2008, Ethiopia lost a cumulative amount in the range of 13-40% of its original level of agricultural output due to climate change making it more vulnerable to produce efficient food for the growing population (Robert S Strauss Center, 2013). In addition, climate change has posed significant damage to the country's natural resources as a result of soil erosion, land degradation, deforestation and increased pressure on water availability. Clearance of natural forests, overgrazing by livestock, water pollution and increased use of agrochemicals have all contributed to food and water insecurity (FAO & ECDPM, 2021).

Climate change effects have also impacted on the country's food distribution, farm incomes, food prices, imbalance in imports and exports, unemployment to many the actors involved in agriculture. The effects continue to pose a high risk to food systems, leading to increased economic pressure, rural to urban migration, more debts to the struggling Ethiopian economy due to more importation and increased nutritional problems.

In its food systems national pathway, Ethiopia stressed that all these challenges must be addressed whilst curbing rapidly growing agricultural greenhouse gas emissions and building enhanced resilience to both ongoing climate change and extreme weather events. The following challenges were highlighted in the national pathway, collated through the national dialogues and consultations the country has conducted thus far (Government of Ethiopia, 2021).






 AT 1: ensure access to safe and nutritious food for all	 AT 2: shift to sustainable consumption patterns	 AT 3: boost Nature positive production	 AT 4: Advance equitable livelihoods	 AT 5: Build resilience to shocks & stress
1.1 Low availability & affordability of nutrient – dense foods	2.1 Low dietary diversity, especially among infants, children & mothers	3.1 Lack of access to agricultural inputs and technologies	4.1 Weak market linkages	5.1 Limited climate adaptation and resilience
1.2 Lack of food safety management infrastructure	2.2 Shift towards unhealthy diets, especially in urban areas	3.2 Lack of access to agricultural and rural financial services	4.2 Limited value addition and processing capacity	5.2 Need for integrated risk and crisis management
1.3 Lack of food fortification, processing and packaging	2.3 Limited dietary guidelines and education	3.3 Soil depletion	4.3 High post-harvest losses	5.3 Need for universal food access, especially in vulnerable areas
		3.4 Lack of adoption of agro-ecological practices	4.4 Weak institutional support	
		3.5 Weak land ownership management infrastructure		

Figure 4: Key challenges of Ethiopia's food system. Source: Government of Ethiopia, 2021

On ensuring access to safe and nutritious food for all, the key challenges include:

- Poorer yield growth in recent years fueled by poor soil quality, lack of high quality seed availability, low usage of agricultural technology and high post-harvest losses
- Lack of production diversity and dietary diversity, where cereals account for 75% of total land cultivation, leading to lack of other crop availability such as fruits, beans and pulses
- Low productivity of livestock due to lesser feed availability, limited access to health services
- Low availability and affordability of nutrient-dense foods and lack of food fortification, processing and packaging capacities.

Ethiopia sees the following challenges in shifting to sustainable consumption diet patterns:

- Problems of dietary diversity, nutrient intake and overall consumption are pronounced in children and mothers
- Overconsumption of non-nutritious foods are growing in urban areas – salt consumption, high sugar consumption, etc. leading to health problems
- Lack of nutrition and dietary education and guidelines

In boosting nature positive production, Ethiopia is facing challenges such as:

- Agricultural intensification leading to deforestation and soil depletion, salination and erosion, biodiversity loss and increasing water scarcity
- Shortage of agricultural inputs and innovative technologies, drought-resistant seed varieties
- In addition to productivity enhancing and nature positive inputs and technologies, adoption of innovative agro-ecological practices is also low. Extension services primarily focus on techniques that boost yield, than techniques that support environmental production
- Lack of access to finance to farmers to facilitate investment in productive technologies and equipment
- Rapid expansion in agricultural land has led to lack of availability of cultivable land
- Weak land management practices and land fragmentation driven by property rights and public land ownership

To advance equitable livelihoods in food systems, Ethiopia has the following challenges:

- Lack of enabling environment and institutional settings for vulnerable actors in food systems
- Vulnerable actors like women, youth, smallholders face entrenched institutional, social norms and practices that limit their access to inputs, land, finance, technology and innovation to enhance sustainable livelihoods
- Weak food market infrastructure and linkages with only a small minority of farmers being fully commercial
- Long value and supply chains between farmers in rural areas and processors in urban and peri-urban areas
- Lack of institutional and regulatory environment for equitable markets ensuring fair value pricing to producers, manufacturers and retailers

Relevant to the context of this case study, in building resilience to vulnerabilities, shocks and stress, Ethiopia is facing the following challenges according to their food systems technical synthesis report on national pathways:

- Growing frequency of climatic shocks and events have exacerbated Ethiopia's drought and food shortage situation.
- To ensure food security in the aftermath of a disaster or shock, Ethiopia considers universal food access as a fundamental solution.

3. Risk analysis

3.1 Climate risk and vulnerability

Ethiopia is highly vulnerable to climate change and the main climate-induced risks include drought and high temperature extremes. The country's climate is highly variable, with average annual temperatures varying from 10°C in the highlands (defined as locations 1500 meters above sea level or higher) to about 35°C in the lowlands. The highlands of Ethiopia are endowed with more predictable rainfall. But, the lowlands experience more erratic rainfall, and this climatic diversity creates distinct agroclimatic zones. Observed climate trends in Ethiopia over a 50-year period reveal that temperatures have increased by an average 1°C since the 1960s and that rainfall is subject to high variability between years, seasons and regions (World Bank, 2021). The trend in rainfall between 1960 and 2006 does not show a consistent pattern: rainfall trends have been also highly diverse for the regions of the country (McSweeney, New, Lizcano, & Lu, 2010).

Climate security risks are most severe in the Afar, Somali, and Tigray regions (WFP & CGIAR, 2021). Variability in climate is already negatively impacting livelihoods and this is expected to continue. For example, climate change-induced weather events have contributed to several people becoming internally displaced.

The diverse agro-ecological zones in Ethiopia pose different levels of sensitivities to climate change impacts. Drought is one of the major climate hazard in Ethiopia, with significant impacts on agricultural productivity and related impacts on incomes, food security, and nutrition. Most of the recent drought and food crisis events have been geographically concentrated in two broad zones of the country, with the eastern and northern parts of the country being the most vulnerable (GCF, 2021). Ethiopia is currently in the middle of one of the worst droughts for 50 years which follows 12 to 18 months of erratic and failed rains which have dried up many water sources (Oxfam, 2016). The most observed trend in climate change in Ethiopia has been a tendency towards lower rainfall during the main growing seasons (March–May and December–February). A decline in rainfall of 15% on average has been associated with anthropogenic Indian Ocean warming (GCF, 2021). This year, Ethiopia has had four consecutive failed rain seasons and is facing one of its most severe droughts in years.

Almost 90% of its surface is vulnerable to severe or extreme climate stresses. Extensive periods of droughts have become more frequent in the past decade and caused significant economic losses, primarily through their impact on agricultural productivity. With more than 16% of the population being severely food insecure, and 67% of the population being employed in the agricultural sector, climate change and variability impacts on the most vulnerable in the country are dire (WFP & CGIAR, 2021).

These changes will cause increased uncertainty and variability in seasons and rainfall as well as increased extreme events in the country. While the lowland is predicted to suffer most with prolonged droughts and increasing temperatures, the highland is predicted to suffer from erratic, irregular and intense rainfall. Rainfall in certain areas of the country is likely to heighten the risk of flooding, loss of life, and damage to property and infrastructure. Intense rainfall could also bring soil erosion, leading to crop damage, decreased yields and increased food insecurity.

Adjacently, environmental problems like soil erosion, forest fires, deforestation, recurrent droughts, desertification, land degradation, pests and diseases and loss of biodiversity and wildlife have also severely impacted the country.

3.1.1 Climate risk and vulnerability in food systems

The climate risks outlined above affect crop and livestock outputs, increasing food insecurity. Around 85 percent of Ethiopians rely on agriculture and pastoralism for their livelihoods, all which are heavily dependent on rainfall. The Ethiopian agriculture sector being rain fed, implies that temperature and rainfall significantly affect crop production, food security and food shortages. Drought and high temperature extremes are the main drivers hindering crop and livestock productivity, increasing household level food and nutrition insecurity, poverty and inequality and decreasing agricultural employment, which in turn are correlated with a higher likelihood and intensity of conflicts. Drought has severely reversed agricultural sector performance gains, inducing famine in certain regions of the country.

Prolonged drought and erratic rainfall across the country have hit harvests and livestock, eating into farmers' and herders' income and meals. In 2022, troubling patterns of rainfall have affected crop and livestock production – a recent report by Famine Early Warning Systems Network (FEWS NET) reported that climate change has caused an unprecedented multi-season drought as portrayed by the worst March-to-May rains in 70 years. The harvest in crop production regions like south Tigray, east Amhara, east Oromiya and northeast Southern Nations, Nationalities and People's region (SNNPR) was estimated to start with one month delay as the onset of rainy season was delayed by 20-40 days (FEWS Network, 2022). There are concerns that the rainfall deficits may lead to a late start to other harvesting seasons, impacting the entire food system in Ethiopia.

Likewise, pasture conditions also remain driest on record in Ethiopia, affecting livestock. This has led to an estimated 2.1 to 2.5 million livestock deaths between late 2021 to mid-May 2022, and herd sizes are likely to decline further given limited livestock births (FEWS Network, 2022). Livestock has been impacted by increased heat conditions, including the effects of radiation, temperature, and humidity. Under present climate conditions, heat stress makes it difficult for animals to keep up with heat dissipation, rendering them vulnerable to heat stress during, at least, part of the year (World Bank, 2021).

Agriculture (crop and livestock) vulnerability to climate change and its impacts as identified in the Ethiopia's National Adaptation Plan:

CLIMATE RISKS



FREQUENT DROUGHT &
OCCASIONAL FLOODS



SEASONAL SHIFT IN RAINFALL
AND TEMPERATURE REGIME



EXTREME EVENTS
INCLUDING HEATWAVES
AND STORMS

POTENTIAL IMPACTS

- Shortening of crop plant maturity period
- Expanding crop diseases
- Low productivity of soil and animals
- Increase in crop failures
- Decrease in livestock feed availability and quality
- Reduced animal health, growth and reproduction
- Increase in distribution of infectious diseases
- Increase in decomposition rate of organic matter
- Contracting of pastoral zones across the country
- Increase in livestock death

3.2 Other factors and stressors

Climate variability is a threat multiplier as it exacerbates the already existing conflict situation in the country. Despite the substantial investments of the government in building resilience at national, community and household levels, improvements have been insufficient to mitigate the

magnitude of pervasive factors like climate and political shocks and stresses, from economic dislocation to civil unrest.

According to the World Food Programme, while conflict remains active in the North, an estimated 24.1 million people are critically food insecure, and 13 million people lack access to sufficient safe water due to drought in southern and eastern regions. An increase of ten days in the year with high temperature (>37 degree Celsius) increases the number of food insecure households, on average, by 3% and that the increase of one food insecure household is correlated with a 3% increase of the likelihood of future conflicts. Subsequently, the war in Ukraine and subsequent rising wheat, fuel and fertilizer costs are also worsening the country's food crisis (IISD, 2022).

There are several sociopolitical, economical and infrastructure challenges that impact the country and hamper its food systems challenges. Border conflicts and internal fighting have displaced hundreds of thousands of Ethiopians over several decades, affecting the already vulnerable communities (WFP & CGIAR, 2021). These challenges have knock-on effects on food and nutrition security, poverty and inequality. For example, it is projected that 6.82 million people in the south of Ethiopia will likely face high levels of food insecurity because of the ongoing drought (IFRC, 2022). Available data from find-and-treat campaigns conducted by UNICEF, as well as proxy Global Acute Malnutrition (GAM) mid-upper arm circumference (MUAC) levels collected by the CDC, suggest that acute malnutrition levels are within the 'Critical' range in Oromia and Somali regions (FEWS Network, 2022).

Ethiopia urgently needs to prioritize building resilience to vulnerabilities, shocks and stress in its food systems. The Government of Ethiopia (GoE) has taken proactive action by launching several initiatives to build resilience, including, but not limiting to the Climate Resilient and Green Economy Strategy, Growth and Transformation Plans, Sustainable Land Management Programme. The launch of the National Adaptation Plan (NAP) has also paved a way forward for Ethiopia's food systems and food security as the plan outlines ways to mainstream climate change adaptation initiatives with ongoing development efforts. The next section discusses the national plans and policies in Ethiopia in relation to climate resilient food systems.

4. Climate, agriculture and food systems policies

4.1 Vision, goals, objectives

Ethiopia aims to achieve middle-income status by 2025 while developing a green (low emissions) economy. Agriculture has been fundamental in Ethiopian government's development strategy and is seen as a major driver for industrialization. The Ethiopian government has been implementing its strategy of Agricultural Development-led Industrialization (ADLI) since 1991 that sees agriculture as the engine of growth. ***Agriculture as an engine for growth*** stands out as the most dominant narrative in Ethiopia.

ADLI was built on the development theories of the 1960s in which agriculture needs to be developed first to facilitate demand for industrial commodities and inputs for industrialization.

Its main thrust has been to:

- improve agricultural extension services;
- promote better use of land and water resources;
- enhance access to financial services;
- improve access to domestic and export markets; and
- provide rural infrastructure (Ministry of Agriculture and Rural Development, 2010)

A number of policies have been designed to help Ethiopia mitigate and adapt to climate change for resilience and improve food security. The current plans like the Growth and transformation plan and Climate Resilient Green Economy (CRGE) outlines how reaching its goals require significant investments to boost agricultural productivity. Ethiopia has prioritized climate resilience in numerous policies to achieve better food security and nutrition, as well as, to mitigate and adapt to climate change while improving its food systems. In the agricultural sector, Ethiopia has a comprehensive and consistent set of policies and strategies, which reflects the importance of the sector in the Nation's development aspirations.

A notable pillar strategy that Ethiopia has been prioritizing recently for development has been to end over-reliance on rainfed agriculture by expanding the country's irrigation system capacities and encouraging irrigation investments. Investment in irrigation continues to be GoE's priority after the 2018 political reform with greater emphasis on infrastructure, including water and irrigation schemes. For instance, In April 2018, the GoE has allowed duty-free imports of irrigation technologies (Ethiopian ATA, 2018).

In food systems particularly, the overall strategy of the GoE has been related to achieving five central goals:

- i. Ensure diversified food production and increase the supply of nutrient-dense foods
- ii. Strengthen innovative supply chain strategies and mechanisms for food management and handling systems
- iii. Promote food production practices that conserve soil health and the environment and provide for better access to agricultural inputs, technologies, and financial services, especially for our rural settings
- iv. Support the development of equitable food systems livelihoods by promoting agro-and food processing that promote food safety while limiting post-harvest losses

- v. Build resilience to vulnerabilities, shocks, and stress.

To unpack the overall strategy on climate-resilient food systems further, as is the mandate of this case study, it is worth looking into the existing plans and policies of Ethiopia.

The section below provides an overview of plans and policies of Ethiopia that relate to climate-resilient food systems.

4.2 National policies

4.2.1 National Adaptation Plan

Ethiopia's NAP (NAP-ETH) builds on the ongoing efforts to address climate change in country's development policy framework, including the Climate Resilient Green Economy strategy and the second Growth and Transformation Plan and the climate resilience strategies and adaptation plans. Recognizing that Ethiopia's adaptive capacities are constrained by limited livelihood options for majority of its population with inadequate ability to withstand or absorb disasters, NAP ETH has been designed to support positive strides in adaptation policies, programs and implementation capacities (Government of Ethiopia, 2019) .

Vision:

The vision for NAP-ETH is to create climate change impact resilient development for Ethiopia and its people.

Goal:

The goal of NAP-ETH is to strengthen integration of climate change adaptation in Ethiopia's long term development pathway, supported by effective institutions and governance structures, finance, capacity development and strengthened systems for disaster risk management.

Objectives and priorities relating to climate-resilient food systems:

To help eliminate food insecurity, the NAP-ETH aims at:

- enhancing crop and livestock productivity by selecting resistant and tolerant varieties through switching and diversification, selection and breeding and by diversifying varieties;
- implementing effective systems for increased use of organic fertilizers and appropriate mechanization
- implementing a strong system of monitoring of crops for diseases and pests
- realizing improved breeding and feeding systems and improved pasture/grazing management
- enhancing water availability and use of appropriate agricultural technologies;
- employing enhanced soil and water conservation methods
- enhance natural resilience to the adverse impacts of climate change by enhancing healthy and well-functioning ecosystems

NAP-ETH has identified 18 adaptation options for implementation across different development sectors and the options relating to climate resilient food systems are mentioned below:

- Enhancing food security through improving agricultural productivity in a climate smart manner.

- Strengthening sustainable natural resources management through safeguarding landscapes and watersheds.
- Improving soil water harvesting and water retention mechanisms.
- Enhancing sustainable forest management
- Strengthening drought, livestock and crop insurance mechanisms
- Improving early warning systems

4.2.2 Nationally Determined Contribution

Ethiopia submitted its nationally determined contribution (NDC) to the United Nations Framework on Climate Change (UNFCCC) in 2016, and formally submitted an updated NDC in 2021. The updated NDC is in line with the country’s development goals as laid out in its Growth and Transformation Plan II, its Climate Resilient Green Economy (CRGE) Strategy, the emerging Long-Term Low Emission Development Strategy, the Green Legacy Initiative, and Ethiopia’s 10-year Development Plan (Government of Ethiopia, 2021).

Most of Ethiopia’s adaptation commitments are focused on agriculture and land use- with priorities in livestock diversification, drought resistant animal breeding, rangeland management and livestock insurance. The key intervention points relating to climate-resilient food systems that Ethiopia’s NDC have recognized are summarized in table below:

Adaptation Intervention	Priorities Outlined in NDC
Agriculture Resilience and diversification	<ul style="list-style-type: none"> • Enhance food security by improving agricultural productivity in a climate-smart manner (promote yield increasing techniques) • Expand the use of improved crop varieties with climate resilient characteristics
Risk reduction, transfer and insurance	<ul style="list-style-type: none"> • Strengthen drought and crop insurance mechanisms for climate risk management
Water management and irrigation	<ul style="list-style-type: none"> • Enhance sustainable natural resources development, management, and watershed protection • Expand the construction of medium and large-scale irrigation systems to enhance food security • Increase the proportion of women shared development and management role in irrigation system • Improve access to potable water to strengthen community climate resilience
Climate information and services	<ul style="list-style-type: none"> • Enhance the climate service data reliability • Increase the number of modern weather condition monitoring stations, number of climate and early warning data and dissemination

4.2.3 10-year development plan

The 10 year development plan of Ethiopia also prioritizes agriculture as one of the key sectors where transformation is crucial. The strategy is focused on expansion of small- to large-scale irrigation development, improving supply of inputs and finance, enhancing the productivity of livestock, protecting the environment and natural resources, improving agricultural production methods, reducing post-harvest loss, promoting research-based food security systems, and promoting import substituting major agricultural crop production (Government of Ethiopia, 2021).

Vision:

The ten-year development plan lays a long-term vision of making Ethiopia an “African Beacon of Prosperity” by creating the necessary and sufficient conditions.

The major focus areas of agricultural development plan are reducing the reliance on rain-fed agriculture by developing irrigation capacity; expanding agricultural mechanization services; enabling highly productive smallholder farmers to become investors by assisting them to have access to additional land; improving animal husbandry, fodder development and animal health; expanding horticulture development; expanding the participation of private investors in agriculture; building institutional implementation capacity within the sector; creating job opportunities; and rendering agriculture more resilient to climate change by reducing the impacts of environmental and climatological changes affecting it.

Goal:

- To increase the total annual quantity of crop production in all production systems from 543 million quintals to 925 million quintals;
- To increase horticulture production from 181 million quintals to 261 million quintals;
- To increase the quantity, variety, and productivity of livestock and fisheries;
- To reduce annual soil pollution from its current level of 20.5 tons CO₂E per hectare to 15.84 tons CO₂E per hectare by enabling farmers and pastoralists to adopt improved technologies and practices, in order to ensure sustainable development and utilization of natural resources
- To raise the rate of annual increase of soil carbon content from 1.8% to 2.18% by increasing the amount of additional annual biomass quantity from 27 million metric tons to 75.2 million metric tons;
- To enhance the reduction of greenhouse gas emissions from 36.84 million metric tons to 125.8 million metric tons by mainstreaming environmental issues into sectoral plans

4.2.4 Climate-Resilient Green Economy (CRGE)

The Climate Resilient Green Economy (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 (Government of Ethiopia, 2012).

The CRGE Strategy is considered 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 plan has prioritized improving crop and livestock production practices for food security and farmer livelihoods while

reducing emissions as one of its four pillars. The strategy identifies opportunities to reduce the country's GHG emissions by 64% by 2030, compared to a business-as-usual scenario with specific interventions for the agricultural sector.

Vision:

The vision of this plan is to make Ethiopia middle-income, resilient to the negative impacts of climate change and achieved with no net increase in greenhouse gas emissions. To realize its vision, the strategy prioritizes agricultural development and climate resilience.

Goal:

The strategy aims to identify the impact of both current weather variability and future climate change on Ethiopia ('challenge'), to highlight options for building climate resilience ('response') and to understand how these options can be delivered ('making it happen').

Objectives:

The strategy is built on four pillars:

- Improving crop and livestock production practices for higher food security and farmer income while reducing emissions (agricultural and land use efficiency measures).
- Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks (increased GHG sequestration in forestry).
- Expanding electricity generation from renewable sources of energy for domestic and regional markets.
- Leapfrogging to modern and energy-efficient technologies in transport, industry, and buildings.

On food and agriculture, the strategy focuses on increasing farm productivity, promoting adoption of more sustainable regenerative farming practices and reducing food losses GHG emissions. Likewise, because much of Ethiopian agriculture remains rain-fed and vulnerable to climate variability, enhancing climate information use in agriculture is among the top priority actions identified in Ethiopia's Climate-Resilient Green Economy (CRGE) strategy.

This plan has been mainstreamed into Ethiopia's second Growth and Transformation Plan.

4.2.5 Growth and Transformation Plan II

Ethiopia's *Growth and Transformation Plan II* (GTP II) aims to spur economic structural transformation and sustain accelerated growth towards the realization of the national vision to become a low middle-income country by 2025. GTP II focuses on ensuring rapid, sustainable, and broad-based growth by enhancing the productivity of agriculture and manufacturing sectors, improving the quality of production, and stimulating competition within the economy (Government of Ethiopia, 2016).

In relation to the agriculture sector development, the GTPII has emphasized on the need for increased and market-oriented crop production and productivity; increased livestock production and productivity; reduced degradation and improved productivity of natural resources; and enhanced food security. The plan aims to transition agriculture to be more market oriented and

to aid and align the agriculture sector development plan with the green economy development strategy.

4.2.6 National Policy and Strategy on Disaster Risk Management

The main objective of the Policy is to reduce disaster risks and potential damage caused by a disaster by establishing a comprehensive and coordinated disaster risk management system in the context of sustainable development. Also, providing a framework that enables to withstand impacts of hazards and related disasters and reduce damage caused by a disaster through establishing an effective, people-centred, integrated, coordinated, accountable, and decentralized disaster risk management system that focuses on multi-hazard and multi-sectoral approaches as well as on measures that need to be taken before, during, and after the disaster period.

4.2.7 Green Legacy Initiative

Launched in 2019, this initiative has a target of planting 20 billion seedlings within 4 years. This initiative is a demonstration of Ethiopia's long-term commitment to a multifaceted response to the impacts of climate change and environmental degradation that encompasses agroforestry, forest sector development, and integrated water and soil resource management. One of the main objectives of the initiative is contribute to food security. In 2022 alone, more than 500 million seedlings were planted – these seedlings were known to have premium values in local and international markets, eg. Avocados, mangoes, apples, papayas. Through this initiative, the country aims to become food self-sufficient (UN DESA, 2022).

4.2.8 Food Systems National Pathways

The national food systems pathway follows in the footsteps of Ethiopia's Homegrown Economic Reform Agenda, which aims to transform Ethiopia from largely agrarian low-income country to an industrialized lower-middle-income country by 2025. It has been carefully designed to both align with and evolve Ethiopia's existing food systems policy ecosystem and key national programs, including; the Homegrown Economic Reform, the Ten-year Development Plan: the Pathway to Prosperity; Food and Nutrition Policy, the Ministry of Agriculture's Nutrition Sensitive Agriculture Strategy and the Multisectoral Food and Nutrition Policy, the Disaster Risk Management Policy (DRM), social protection policies such PSNP5 (Productive Safety Net Program), and the Seqota Declaration, among others. The pathway also incorporates lessons learnt from the Government of Ethiopia's previous plans and programs: agricultural and nutrition plans, including GTPs (Growth and Transformation Plan) I and II, and ADLI (Agriculture Development Led Industrialization) (Government of Ethiopia, 2021).

4.2.8.1 Ethiopia's vision for food systems

The vision for Ethiopia's food systems is for holistic transformation of the country's food systems from production to consumption that promotes enhanced food safety, nutrition and diets, improved livelihoods, greater land preservation and restoration and greater resilience to shocks and stress (Government of Ethiopia, 2021).

4.2.8.2 The National Pathway

Ethiopia has made significant progress in charting its food systems transformation pathway through national dialogues a series of consultative processes. The Government of Ethiopia launched the Ethiopian Food Systems process in November 2020 with the objective of defining

Ethiopia's vision and pathway for national food systems transformation. The process has been built around the following dialogues and formal launch of the Ethiopian Food System:

- ***EFS Dialogue 1*** Current and Future Prospects of the Ethiopian Food Systems: aimed at identifying key trends in the food systems and challenges that will need to be addressed for each UNFSS Action Track to achieve the SDGs;
- ***EFS Dialogue 2*** Towards transforming Ethiopia's food systems: aimed at evaluating and selecting 'game changing solutions' (see below) that will address the challenges identified in EFS Dialogue 1 and craft a path to transforming Ethiopia's food systems and achieving the SDGs; and
- ***EFS Dialogue 3*** the EFS Launch - aimed at publicly affirming the Government of Ethiopia's commitment to the EFS Plan and calling key stakeholders, development partners and the country as a whole to action (Government of Ethiopia, 2021).

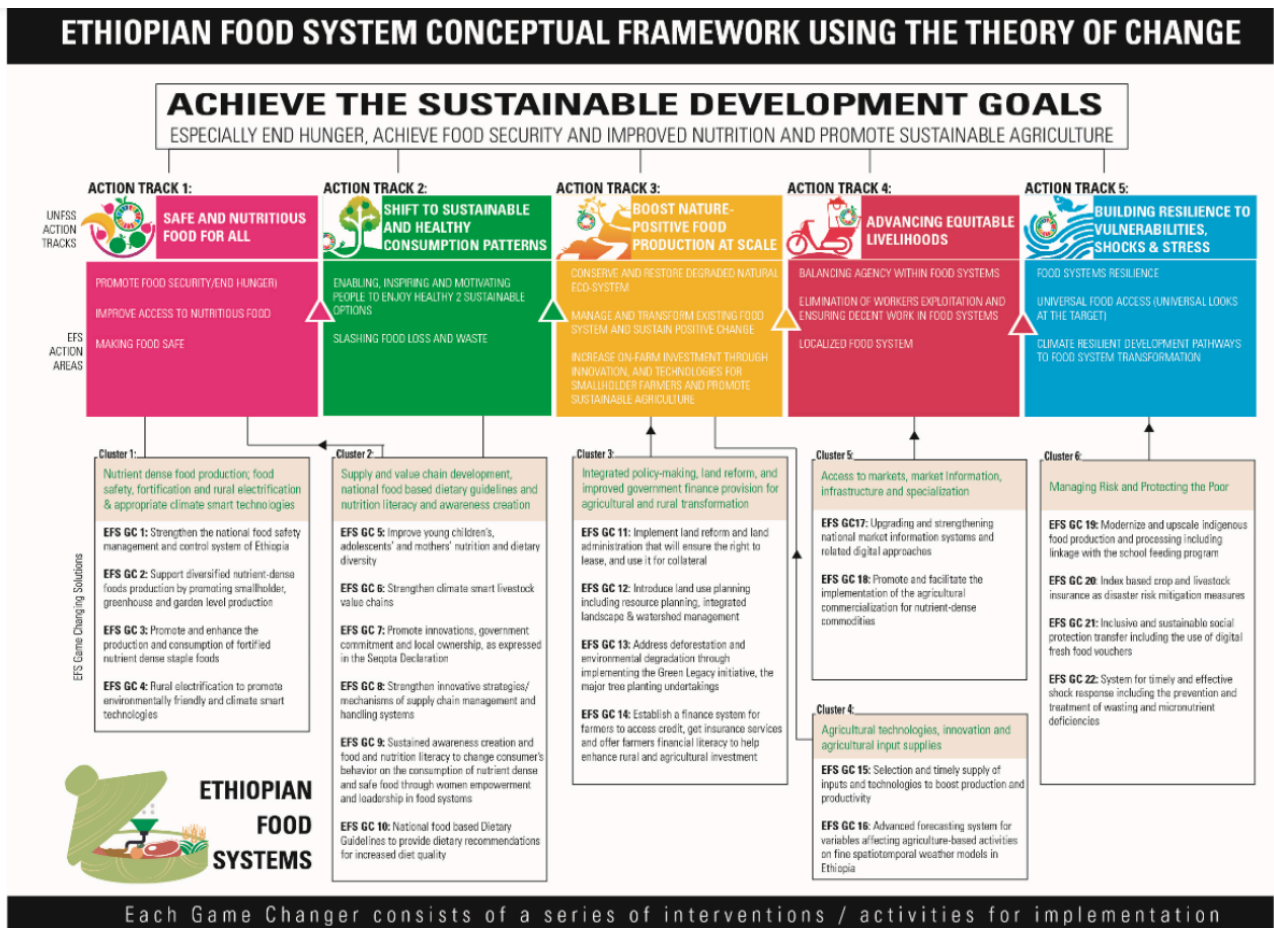
The country's pathway follows the footsteps of Ethiopia's Homegrown Economic Reform Agenda, which aims to transform Ethiopia from largely agrarian low-income country to an industrialized lower-middle-income country by 2025, as well as, other existing food systems policies and national programmes.

4.2.8.3 Ethiopia's priorities in food systems

Ethiopia has identified and prioritized 22 game changing solutions grouped into 6 clusters as below:

1. Nutrient-dense food production; food safety, fortification and rural electrification and appropriate climate smart technologies;
2. Supply and value chain development, national food based dietary guidelines and nutrition literacy and awareness creation;
3. Integrated policy-making, land reform, and improved government finance provision for agricultural and rural transformation;
4. Agricultural technologies, innovation and agricultural input supplies;
5. Access to markets, market information, infrastructure, and specialization; and
6. Managing risk and protecting the poor.

In relation to building climate resilience, the food systems pathway of Ethiopia acknowledges that the country is experiencing climate change challenges and need to promote modernizing climate adaptation mechanisms and the adoption of effective early warning systems and integrated risk and crisis management. The fourth cluster on agricultural technologies, innovation and agricultural input supplies and the sixth cluster on managing risk and protecting the poor are particularly relevant for this case study (Government of Ethiopia, 2021).



To drive increase access to and adoption of agricultural technologies and inputs, two game changing solutions are proposed:

- Selection and timely supply of agricultural inputs and technologies to boost production and productivity; and
- Advanced forecasting system for variables affecting agriculture-based activities on fine spatiotemporal weather models in Ethiopia;

Likewise, to manage and mainstream risk and protect the poor, the following game changing solutions proposed by Ethiopia are particularly relevant to this case study:

- Formalize and integrate disaster risk management including index-based crop and livestock insurance
- Strengthen system for timely and effective shock response including the prevention and treatment of wasting and micronutrient deficiencies.

5. Institutional Arrangements and coordination

In the agricultural sector, two primary regime institutions remain fundamental in shaping the overall agricultural development at the national level – the Ministry of Agriculture and Natural Resources (MoANR) and Agricultural Transformation Agency (ATA). MoANR is responsible for overall policy development and implementation, and ATA is mandated to take a strategic and holistic perspective on how to transform the agricultural sector (Järnberg, Enfors-Kautsky, Dagerskog, & Olsson, 2018).

MoANR is divided into two directorates, focused on agricultural production and natural resource management respectively. They encompass two major donor-funded programmes – the Agricultural Growth Programme (focused on agricultural production) and the Sustainable Land Management Programme (focused on natural resources management). National and regional agricultural research institutes also play a major role in developing agricultural campaigns and policies.

The diagram below depicts the key government actors and their associated institutional structures in the agricultural sector.

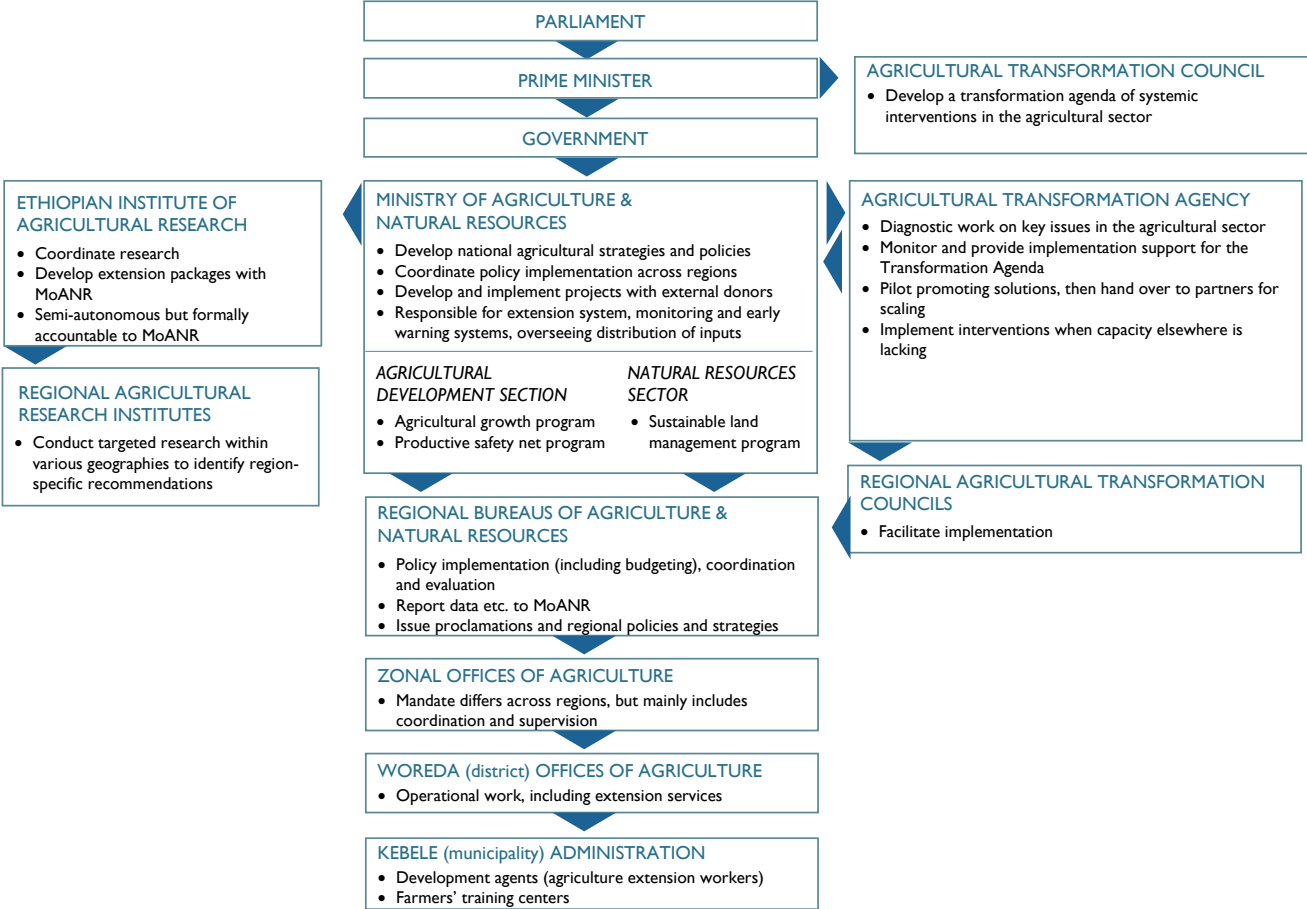
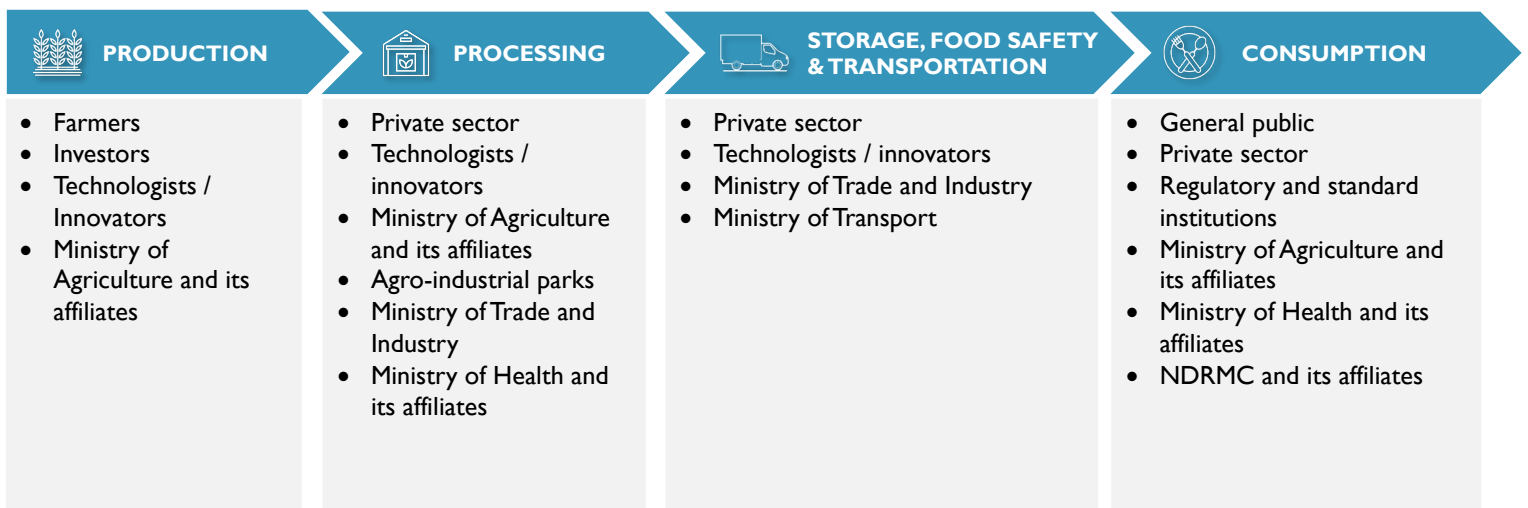


Figure 5: Institutional arrangement in Ethiopia's agriculture sector

In relation to the Climate Resilient strategies, Ethiopia has put in place an institutional architecture which follows sectoral approach to implement CRGE/NDC interventions. In this regard, the Environment, Forest and Climate Change Commission (EFCCC), is the lead agency for the coordination of Ethiopia’s response to climate change and is the national focal point to the UNFCCC; it formulates environmental laws and standards; and develops, coordinates and guarantees the implementation of sectoral programs and plans. In implementing the climate resilient green economy strategy, a facility was established in 2013 by the Ministry of Finance. EFCCC is responsible for technical elements and day-to-day administration, as well as developing guidance and rules for CRGE implementation.

A food systems focused institutional arrangement is yet to be developed by the Government of Ethiopia, but the following diagram shows the actors involved in the food systems process in Ethiopia.



Other stakeholders involved in climate resilient food systems in Ethiopia include FAO, UNEP, World Bank, DFID, USAID, CGIAR, EU.

EFS participating institutions included:

Ethiopian Government	
NGOs and CSOs	
UN bodies, International Organizations & development partners	
Universities & research institutions	
Private sector	

6. Ongoing projects, programmes and initiatives in climate resilient food systems

The Ethiopian government is putting efforts to improve agricultural productivity and its resilience to climate change effects through various development and transformation programmes, advocating for climate-smart adaptation strategies and enabling policies. Most of these strategies focus on efforts to enhance the adoption of climate-smart agriculture (CSA) in agricultural production. Importantly, the adoption of CSA and associated technologies has been shown to increase dietary diversity and improve the quality of the food consumed through increased calorie and protein availability, leading to improved nutritional outcomes (Stifel & Minten, 2017); (Teklewold, Gebrehiwot, & Bezabih, 2019).

The case study has identified projects mainly in areas of climate risk management and DRR (climate information), water management and nexus approach, soil health and fertility, and climate smart technologies that translate to climate-resilient food systems. The practices that have been currently tested and promoted to farmers in Ethiopia are below, along with the benefits and limitations (Ogola, 2021).

Theme	Practices	Benefits	Limitations
Climate risk management and DRR	Early warning systems like improved weather information, pest and disease monitoring	<ul style="list-style-type: none"> Increased farmers' preparedness and early planning for response Reduced farmer yield losses Improved income 	<ul style="list-style-type: none"> Expensive to resource poor farmers Lack of long-term early warning systems information to farmers
Water management, irrigation, nexus	Efficient water utilization, mulching, in-situ water harvesting and conservation Small scale irrigation systems	<ul style="list-style-type: none"> Improved yields, income and food security Reduced water runoff and topsoil erosion Increased water productivity 	<ul style="list-style-type: none"> Open structures prone to dryness Expensive to poor farmers
Agricultural, soil and land practices	Crop residue management, contour farming, agroforestry	<ul style="list-style-type: none"> Reduce emission from nitrous oxides and methane Improved soil productivity Create microclimate that improve the agricultural productivity Carbon sequestration 	<ul style="list-style-type: none"> Large amount of nutrients required Alternate host to pests and other invasive species
Climate smart technologies	Crop diversification, efficient fertilizer application, reduced tillage, crop rotation,	<ul style="list-style-type: none"> Reduced emissions Ensured yields Alternate livelihood income 	<ul style="list-style-type: none"> Limited to larger areas High farm input requirement

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|--------------------------------------|------------------------|--------------------------------------|
| popularization of new crop varieties | • Carbon sequestration | • Pest and weed control difficulties |
|--------------------------------------|------------------------|--------------------------------------|
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6.1 Climate risk management and Disaster Risk Reduction

Following a massive drought in the 1970s, the Government of Ethiopia established the Relief and Recovery Commission (RRC) to manage the effects of droughts in the country (DPPC, 2005). Ethiopia's early warning system (EWS), established in 1976, has been consistently improved over the last decades and is supported by various government ministries. The current EWS monitors all threats to food insecurity, including drought, pests, and diseases. Given that rain-fed agriculture comprises more than 80% of the crop area in Ethiopia, predictions that can account for potential climate events can facilitate efforts of governmental agencies to proactively engage in preparedness and mitigation efforts.

Several weather institutions and agencies such as Agro-met, Weather Impact (WI) and Geodata for Agriculture and Water (G4AW) are working closely with the Ethiopian National Meteorological Agency (NMA) department to disseminate climate information to households in Ethiopia (Ogola, 2021). This has been carried out through platforms like text messaging, radio, television. Despite these efforts, many farmers in Ethiopia still lack access to climate information services.

Current projects¹ being conducted in Ethiopia for climate risk management and DRR include the following:

- **NextGen Agricultural Drought Monitoring and Warning System (NADMWS):** Using satellite-based remote sensing technology, combined with detailed land-use maps, seasonal forecasts, national crop statistics, crop phenology and other country-specific data, this system helps to monitor agricultural areas or “hotspots” with a high likelihood of water stress at the national, regional, zonal and woreda (district) levels.
- **Agro-Met:** The Agro-Meteorology project of the Ethiopian ATA was designed to integrate localized weather and climate information into smallholders' agronomic practices. It is creating a system that interprets the seasonal and short-term climate forecasts provided by the National Meteorology Agency in the context of smallholders needs and translates them into a format that supports agronomic decision-making. Activities of this initiative include the capacity building of stakeholders engaged in generating, communicating, and utilizing agro-meteorological information and the procurement and installation of 50 Automatic Weather Stations (AWSs) in Farmers Training Centers.
- **Weather Impact's CommonSense:** The CommonSense project in Ethiopia targets smallholder farmers in different regions in the country, directly or through actors across their value chain including unions, cooperatives, microfinance institutions (MFIs) and extension services. By providing them with actionable information based on earth observations, geographic and other data, the project aims to strengthen these value chains and eventually improve their livelihoods and food security. CommonSense develops a platform of specialized information services such as unions' management systems, a

¹ More details of the projects in Annex

weather forecast SMS service for smallholders, tools for loan portfolio monitoring and risk assessment and tools in support to extension services (Weather Impact, 2022).

Weather Impact is also working in partnership with the National Meteorological Agency Ethiopia, Wageningen Environmental Research and Apposit to design an automated Agro-meteorological Advisory generation system that supports government organizations with optimized decision support for climate smart agriculture based on data and information on climate, weather, soils, crop and livestock.

- **Partners for Resilience:** The Partners for Resilience project promotes four building blocks, helping communities to anticipate the risks they face, respond when disaster strikes, adapt to changing risks and livelihood options and address the root causes in implementing disaster risk reduction. The project introduced agricultural innovation into project areas, including pre-harvest technology and soil and water conservation techniques, leading to increase in average annual income from on-farm activities.
- **Scaling-up drought anticipatory actions (AAs) for food security in Africa:** By acting early, Anticipatory Action (AA) programmes aim to avoid and reduce food insecurity instead of waiting for negative impacts from climate shocks to materialize. WFP Ethiopia Country Office has been implementing a multi-year AA project since 2019. The approach is two-fold: engage in longer-term systems building for AA (which aims at strengthening national capacities for early warning/AA in a wider sense), and provide direct delivery of AA (lifesaving/humanitarian activities). In 2021, in the Somali region, two AAs were implemented following a drought trigger: anticipatory cash transfers and dissemination of early warning information. These AAs made these households more resilient to climate change, mitigating its impact on food security, lives and livelihoods.
Government partners: Somali Region Disaster Risk Management Bureau (DRMB), National Meteorological Authority (NMA)
Non-government partners: Somali Micro Finance Institution and Mercy Corps
- **Index-based livestock insurance (IBLI):** IBLI is a climate risk financing for the livestock keepers in the drylands whereby insurance products are offered to pastoral communities against drought related risks. When satellites detect a drought in the insured pastoralist's chosen location where he/she grazes her animals, he/she receives an emergency payment into his/her bank account. The state of the pasture is monitored over a given season and when the level of pasture falls below a certain threshold (against historical data of severe droughts), payouts are triggered, which is supposed to aid pastoralists in accessing and providing essential services for their households and livestock, thus keeping them alive during severe dry conditions. Stakeholders: ILRI, CGIAR
- **Nexus Gains:** This Initiative aims to realize multiple benefits across water, energy, food and ecosystems in selected transboundary river basins, by leading global nexus thinking and providing tools, guidelines, training and facilitation for analysis and research for development. The initiative applies trade-off analyses and foresight methodologies to support national and local government capacities in research evidence and data in policy and decision-making processes; boosts water productivity and water storage management to improve food and nutrition security; develops business and finance models for clean energy and water systems; strengthens the Water-Energy-Food nexus governance, ensuring marginalized voices are heard and develops capacities for emerging women leaders (CGIAR, 2021).
- **Satellite Index Insurance for Pastoralists of Ethiopia (SIPE):** SIPE provides access to insurance against poor rainfall for vulnerable pastoralists and agro-pastoralists

in exchange for contributing to the construction and rehabilitation of community assets in the Somali region. The insurance product is intended to protect livestock assets through early payouts so pastoralists can purchase feed or access veterinary services. **Stakeholders and Partners:** Somali Regional Government Institutions: Regional Bureau of Agriculture and Natural Resource Development (BoANRD); Regional Bureau of Livestock Production (BoLP); SNP, Government of Somali Region, coinsurance pool (Africa Insurance Company, Ethiopia Insurance Company, Oromia insurance company, Nyala Insurance Company), WTW, SCOR Mercy Corps; Somali Microfinance Institute (SMFI)

Despite the growing momentum in climate information initiatives and projects in Ethiopia, there have been concerns and challenges around the collection of climate data. The Ethiopian Meteorological Institute (EMI), which is mandated with collecting and providing weather and climate information, has identified the challenge that has stemmed from geographically sparse and poorly maintained surface and upper air stations alongside underinvestment in satellite data reception and processing systems (WMO, 2011). This bottleneck poses implications for agricultural and food security planning, monitoring, and early warning.

6.2 Water management and nexus approach

Despite being the “Water Tower of Africa”, as Ethiopia is the home to headwaters of Blue Nile and many other freshwater lakes, Ethiopia faces different types of climate change related risks, including, reduced rainfall, drought, and flooding.

The climate variability, together with intensive and inefficient agricultural water usage in the country, are leading to water shortages and endangering food security. The country is exposed to highly variable rainfall, making farmers lose their agricultural production because of recurrent droughts, floods or late onset of rains, exacerbating the already tight water supply situation and leading to poor yields and food insecurity. Nearly 25% of Ethiopia’s population lives in areas of high-water stress, and rapid urbanization in the cities and surrounding communities have jeopardized water resilience in the country (WRI, 2021).

As part of its 10-year development plan, the Ethiopian government has prioritized irrigation and with a plan to irrigate 5 million hectares more of agricultural land to protect the country. The Ethiopian government and the Global Water Fund (GWF) and Partners for Resilience (PFR) have implemented watershed ecosystems restoration and irrigation development to reduce water scarcity for agricultural production and improved food security. However, these projects have not reached the smallholder farmers in the region and to ensure the country endures, overcomes and recovers from water-related shocks, the long-term availability and performance of water supply systems need to be strengthened.

Below is a list of projects relating to water management and nexus approaches:

- **Participatory Small-scale Irrigation Development Programme II:** PASIDP II is a participatory irrigation development project led by IFAD to reduce small-scale farmers’ vulnerability to adverse weather conditions by increasing the area of arable land under irrigation (IFAD, 2016). PASIDP II will improve the access of farmers to a secure irrigation production system and enhance water efficiency through climate-smart agriculture in the adjacent watersheds. In addition, the programme will support linkages to markets and services so that smallholder farmers can increase their productivity, competitiveness and incomes. It will also enhance their resilience against external shocks and those induced by

adverse weather and climate conditions, such as drought. The programme thus aims to improve farmers' prosperity, food security and nutrition.

The project envisages the development of about 18,400 hectares of small-scale irrigation schemes in four regions: Amhara, Oromia, Tigray and the Southern Nations, Nationalities and People's Region. Particular attention will be given to women, young people and vulnerable groups. In addition to increasing agricultural productivity, incomes and resilience of ecosystems and the rural population, the programme is expected to create 15,000 new jobs. **Stakeholders involved:** *Ministry of Agriculture*

- **Integrated Shallow Groundwater Irrigation Development:** Developed by the Ethiopian Agricultural transformation Agency, the Integrated Shallow Groundwater Irrigation Development project intends to enhance the access of smallholder farmers to groundwater-based irrigation practices to increase production and productivity of vegetables, field crops, and fodder. Additionally, it seeks to enable smallholder farmers to adapt to climate change by reducing dependence on increasingly erratic rainfall in regions like Oromia, Amhara, SNNPR and Tigray.

6.3 Agricultural, soil and land practices

Ethiopian soils have been subjected to soil degradation over the past 3 decades due to poor land management practices and deforestation leading to 85% and 23% of the land degraded at various levels and as hotspots respectively (Gebreselassie, Kirui, & Mirzabaev, 2015). Studies have shown that land degradation has cost the country 2-3 percentage points in agricultural GDP per year, with soil erosion costing nearly \$305 million per year (GCF, 2021).

To overcome this, the development plan of Ethiopia outlines the following targets for soil health and fertility:

- To reduce annual soil pollution from its current level of 20.5 tons CO₂e per hectare to 15.84 tons CO₂e per hectare by enabling farmers and pastoralists to adopt improved technologies and practices, in order to ensure sustainable development and utilization of natural resources;
- To raise the rate of annual increase of soil carbon content from 1.8% to 2.18% by increasing the amount of additional annual biomass quantity from 27 million metric tons to 75.2 million metric tons

Building climate resilient food systems requires good soil health, fertility and practices that increase soil carbon and reduce emissions.

Projects relating to agricultural, soil and land practices include:

- **Integrated Landscape Management to Enhance Food Security and Ecosystem Resilience:**

This project, led by UNDP intends to enhance long-term sustainability and resilience of food production systems by addressing the environmental drivers of food insecurity in Ethiopia. It targets six regions – Amhara, SNNP, Oromia, Tigray, Afar and Somali – across two biodiversity hotspots, Eastern Afromontane and Horn of Africa. The project is focused on establishing institutional framework for enhancing biodiversity within food production, systems, scaling integrated landscape management to assess resilience, food security and environmental benefits and creating the learning, monitoring and assessment processes (Resilient Food Systems Knowledge Center, 2021).

Stakeholders involved: At national level, major stakeholders involved in the RFS Ethiopia project include the following ministries: Ministry of Environment, Forest and Climate Change; Ministry of Agriculture; and Ministry of Finance and Economic Development.

Other stakeholders directly engaged throughout the project include: community members and resource users and managers at the local level; NGOs; national and international partners and agencies; universities in the 12 targeted areas; local authorities of Oromia, Amhara, Tigray, Afar and Somali Regional States; and the Woreda Agricultural, Water and Energy and Environment Protection and Land Use Offices.

- **ETHIOSIS:** ETHIOSIS is a project that was launched by the Ethiopian Government's Agricultural Transformation Agency (ATA). This project aims to develop soil fertility maps and fertilizer recommendations for each region. The information and soil maps were developed using soil infrared spectrometry and remote sensing techniques. The resultant high quality soil information informs policies, interventions, and recommendations across Ethiopia, particularly those involving fertilizer, land use and degradation, and seed varieties. The Ethiopian Government's generated digital soil maps are now being used to inform fertilizer blending decisions.
- **SLM II Programme:** SLM II is an expansion of the SLM Project, which required to address the serious land degradation that is being exacerbated by climate change. SLMP II sought to scale up this support by expanding the geographical coverage to 135 watersheds and continued addressing poor farmland management practices, rapid depletion of vegetation cover, unsustainable livestock grazing practices, and land tenure insecurity. The two projects introduced SLM practices and improved livelihood activities in significant areas of the highlands. The two projects treated more than 860,000 hectares of degraded landscapes in 1,820 microwatersheds, attaining about 98 and 95 percent of the projects' revised and original targets, respectively, in promoting the adoption of improved land management practices on communal land and individual farmlands managed by households.

The ministries involved are the Federal Ministry for Economic Cooperation and Development and the Ministry of Agriculture and Natural Resources

6.4 Climate-smart technologies and other initiatives

- **Food Systems Resilience Program (FSRP):** FSRP is World Bank's investment project that aims to increase the resilience of food systems and its preparedness for food insecurity. The project will assess climate risks to smallholder farmers in the crops and livestock sectors and identify digital adaptation tools that can address the risks and assess opportunities and constraints to their deployment. It is expected that the project will result in 2.4 million farmers adopting resilience-enhancing technologies and practices; 15% reduction of food insecure people in program targeted areas; 20% increase in yields of cereals and pulses in households benefiting directly from the project and a 25% increase in volume of agricultural products sold in domestic and regional markets.
- **Scaling up Climate Ambition on Land Use and Agriculture through NDCs and NAPs (SCALA):** The SCALA programme will leverage participatory methods to address Ethiopia's institutional and financial barriers to mainstream climate change at all

administrative levels, to allow for a transformative shift in agriculture and land use sector. It will enhance institutional capacities of Ethiopia to support the management of climate budget tagging systems, to undertake climate finance and resource mobilization and engage the private sector to increase investments in climate action. It also intends to develop stronger knowledge and information sharing platforms for bridging the gap between national, regional and woreda level governance mechanisms. **Stakeholders and partners:** United Nations Development Programme (UNDP), Food and Agriculture Organization of the United Nations (FAO), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). **Donor:** German International Climate Initiative

- **R4 Rural Resilience Initiative (R4):** The Rural Resilience Initiative (R4) is part of the G20 InsuResilience Global Partnership. R4 aims to bolster the Ethiopian agricultural sector with protective measures against climate risk. This initiative led by WFP aims to ensure the food security, nutrition, livelihoods and climate risk resilience of vulnerable people and smallholder farmers in Ethiopia through improving access to and management of community assets, providing access to weather index-based insurance, stabilizing incomes and improving access to financial services. When droughts occur and farmers receive compensation for weather-related losses, they have more chances to overcome hunger, achieve food security and invest in their productivity and income diversification. The approach targets beneficiaries of the Productive Safety Net Programme, as well as vulnerable farmers. **Stakeholders and partners:** Environment, Forestry and Climate Change Commission (EFCCC) Ministry of Agriculture and Rural Development (MoARD) – Productive Safety Net Programme (PSNP); Self Help Africa (SHA), Oromia Insurance Company (OIC), Willis Towers Watson.
- **Africa Climate security observatory:** *This project monitors, assesses, and alerts policymakers on the existing and upcoming climate security crises.* The Observatory will seek to address the risk of tension, instability or conflict by contributing to conditions and factors known to reduce the likelihood of violent conflict emerging, which include:
 - Assisting national, local, or community authorities in developing the capacities to provide adequate and appropriate services and equitable access to public goods
 - Provide timely and relevant data/evidence for the creation and implementation of appropriate climate adaptation plans and frameworks
 - Help scale-up innovative technologies and climate-smart practices through which economic livelihoods are safeguardedA pilot of the Climate Security Observatory digital interface is under development in partnership with WFP.
- **Farm Africa’s Market Approaches to Resilience (MAR):** This project is implemented in lowland Ethiopia. The MAR project has applied a system approach to increase capacities of lowland Ethiopians to cope with climate shocks as part of a bigger resilience and adaptation programme funded by the UK Government. The project aims to address multiple drivers of vulnerability simultaneously, so to increase communities’ resilience by increasing their ability to manage their resources efficiently as well as managing daily risks. This is done by promoting economic opportunities, stimulating diversification of economic activities and incomes, as well as increasing adaptation capacities to risks.
- **Excellence in Agronomy Initiative:** The Initiative led by CGIAR aims to deliver agronomic gain at scale for millions of smallholder farming households in prioritized

farming systems, with emphasis on supporting women and young farmers, to demonstrate measurable impact on food and nutrition security, income, water use, soil health and climate resilience (CIMMYT, 2022).

- **Ukama Ustawi - Diversification for Resilient Agrifood Systems in East and South Africa:** this initiative led by CGIAR is focused on transforming Africa's agriculture sector through research and promotion of policies, technologies, services and best practices by finding inclusive, science-based ways for agribusiness SMEs to support resilient and intensified maize production. To speed the transition, the initiative engages farmers in research that pursues water-secure, low-emission crop production and improves access to innovative digital and financial tools. These tools can empower producers to efficiently cultivate and sell a range of crops better suited to withstanding an increasingly erratic water supply (CGIAR, 2021).

7. Priority actions in climate and food systems

7.1 Climate change and food systems priorities

Relevant to climate-resilient food systems, the case study focuses on the priority options and goals identified in the NDC, NAP and the food systems national pathway of Ethiopia.

Out of the 18 adaptation options outlined in NAP-ETH, the following six adaptation options are prioritized in the agriculture and land-use sectors, which can be foundations for climate-resilient food systems:

- **Enhancing food security through improving agricultural productivity in a climate smart manner.** This adaptation option will focus on enhancing crop and livestock productivity by selecting resistant and tolerant varieties through switching and/or diversification, selection and breeding and by diversifying varieties. Specific to crops, effective systems for increased use of organic fertilizers and appropriate mechanization will be implemented. A strong system of monitoring of crops for diseases and pests will be implemented. For both crops and livestock enhanced water availability, use of appropriate agricultural technologies and enhanced soil and water conservation methods will be employed.
- **Strengthening sustainable natural resources management through safeguarding landscapes and watersheds.** This adaptation option will have multi-sectoral and trans- regional implications including a focus on agriculture – rehabilitating degraded lands.
- **Improving soil water harvesting and water retention mechanisms.** For agriculture, this adaptation option will increase irrigation agriculture, improve systems for soil moisture retention in arid environments, develop water infrastructures for vulnerable people, improve water allocation and transfer governance and implement diversified water harvesting technologies.
- **Enhancing sustainable forest management** by creating enabling situations for sustainable management of forest resources and its contribution to the livelihoods of forest dependent communities and the national economy at large. In particular, the contribution of forest resources to other production sectors, mainly energy, agriculture and industry will be acknowledged and mainstreamed.
- **Strengthening drought, livestock and crop insurance mechanisms.** This adaptation option will promote preparedness related to risk reduction and create insurance schemes for anticipated climate risks, including drought and flood leading to crop failure.
- **Improving early warning systems.** This adaptation option will enhance planning for disaster and climate risk management; reinforce early warning systems related to both quick and slow onset disasters; and install knowledge management system, climate information exchange systems and enhanced networking capabilities, which are all vital for effective data sharing and decision making (Government of Ethiopia, 2019).

The overall strategy of the GoE on food system transformation has been related to achieving five central goals:

- **Nutrient-dense food production, food safety, fortification and rural electrification:** This priority focuses on food safety, food fortification for increased

production and reduced harvest losses to increase food availability and food safety standards. It aims to a) improve diversity of and increase production of nutrient-dense crops such as fruits and vegetables; b) increase the accessibility and improve quality of nutrient-dense food, vegetables and fruits; c) expand market access to vulnerable groups and expand markets for nutritious foods; d) ensure access to labor and energy saving technologies and improve the decision making role of women through providing skill based business and other related trainings; e) give special emphasis to target the nutritionally vulnerable populations, and f) maintain or improve the agricultural natural resource base (i.e. water, soil, air).

- **Supply and value chain development, national food based dietary guidelines and nutrition literacy:** This priority is focused on improving the availability of safe and nutritious food and shifting to sustainable consumption patterns through strengthened value chains for high-priority commodities and enhanced supply and value chain management, national dietary guidelines and sustained awareness generation.
- **Integrated policy-making, land reform, and improved government finance provision for agricultural and rural transformation:** This priority is focused on land reforms, land administration, planning, watershed management, access to improved inputs and technologies, and creation of inclusive agricultural financing systems to support smallholders.
- **Agricultural technologies, innovation and agricultural input supplies:** This priority aims to enhance adoption of agricultural inputs like improved seed varieties, enhanced livestock breeds, fertilizers, agrochemicals and microorganisms, innovation and technologies.
- **Access to markets, market information, infrastructure, and specialization:** This priority is focused on access to markets and market information systems, including promoting agricultural commercialization, ultimately aiming for supporting more equitable livelihoods for both farmers and other market actors like women, youth and indigenous populations.
- **Managing and mainstreaming risk and protecting poor:** The ensuring crises and disruptions have exposed the fragility of Ethiopia's food systems. Hence, this priority aims at building back more resilient, inclusive, environmentally sustainable food systems (Government of Ethiopia, 2021).

7.2 Implementation strategy

To achieve the goals of the food systems priorities outlined above, a general strategy for implementation have been outlined in NAP-ETH and the national food systems pathways:

Priority Identified In	Priority	Implementation Strategy
NAP-ETH	Enhancing food security through improving agricultural productivity in a climate smart manner	Ensure that climate change adaptation is proactively mainstreamed in the agriculture sector, including programs and projects, agriculture productivity is increased, diversity is enhanced, climate-smart agricultural practices are adopted by smallholders and households are food secure.
NAP-ETH	Strengthening sustainable natural resources management through safeguarding landscapes and watersheds	Ensure natural resource management is prioritized in vulnerable landscapes and resilience of rangelands and watersheds are increased
NAP-ETH	Improving soil water harvesting and water retention mechanisms	Ensure increased use of rainwater harvesting methods, increased implementation of soil and water conservation. Investment in irrigation continues to be GoE's priority after the 2018 political reform with greater emphasis on infrastructure, including water and irrigation schemes.
NAP-ETH	Enhancing sustainable forest management	Ensure increased awareness of climate change impacts on forests, forest management and governance systems, afforestation, reforestation and conservation of natural forests
NAP-ETH	Strengthening drought, livestock and crop insurance mechanisms	Ensure farmers and herders are insured against climate risks through enabling financial mechanisms to accommodate drought. Ensure insurance agencies are capacitated to provide drought and crop insurance
NAP-ETH	Improving early warning systems	Improve Early warning prediction and communication through strong collaboration and

		<p>integration between data providers and implementers. Ensure that vulnerable people have access to early warnings for climate hazards with proper communication mechanisms</p>
Food Systems Pathway	Nutrient-dense food production; food safety, fortification and rural electrification and appropriate climate smart technologies	<ul style="list-style-type: none"> • Strengthen the national food safety management and regulation system of Ethiopia by assessing and upgrading the national food control system in collaboration with relevant stakeholders and focusing on selected value chains / sectors • Support diversified food production to increase the supply of nutrient-dense foods • Promote and enhance the production and consumption of fortified nutrient-dense staple foods through using industrial food fortification and biofortification and public and private partnership initiatives • Rural electrification to promote environmentally friendly and climate resilient technologies*
Food Systems Pathway	Supply and value chain development, national food based dietary guidelines and nutrition literacy and awareness creation	<ul style="list-style-type: none"> • Improve young children's, adolescents' and mothers' nutrition and dietary diversity through a systematic analysis and a systems approach • Strengthen climate smart livestock value chains • Promote innovations, government commitment and local ownership • Strengthen innovative strategies and private sector engagement mechanisms for supply chain management and handling systems • Sustained awareness creation and food and nutrition literacy to change consumer's behavior on the consumption of

		<p>nutrient-dense and safe food through women empowerment and leadership in food systems</p> <ul style="list-style-type: none"> • National food based Dietary Guidelines to provide dietary recommendations for the Ethiopian population two years and older for increased diet quality
Food Systems Pathway	Integrated policy-making, land reform, and improved government finance provision for agricultural and rural transformation	<ul style="list-style-type: none"> • Implement land reform and land administration that will ensure the right to lease, and use it for collateral to facilitate land consolidation, adoption of innovation, and reduce environmental degradation* • Introduce land use planning including resource planning, integrated landscape & watershed management* • Establish finance system for farmers to access credit, get insurance services and offer farmers financial literacy to help enhance rural and agricultural investment, and support primary investment on farms*
Food Systems Pathway	Agricultural technologies, innovation and agricultural input supplies	<ul style="list-style-type: none"> • Selection and timely supply of agricultural inputs and technologies to boost production and productivity* • Advanced forecasting system for variables affecting agriculture-based activities on fine spatiotemporal weather models in Ethiopia
Food Systems Pathway	Access to Markets, Market Information, Infrastructure and Specialization	<ul style="list-style-type: none"> • Upgrade and strengthen national market information systems and related digital approaches for mapping to strengthen evidence-based

		<p>agricultural development planning</p> <ul style="list-style-type: none"> • Promote and facilitate the implementation of the agricultural commercialization through creating production-specific specialization corridors for nutrient-dense commodities
Food Systems Pathway	Managing and Mainstreaming Risk and Protecting the Poor	<ul style="list-style-type: none"> • Modernize and upscale indigenous food production and processing for the general population • Formalize and integrate disaster risk management including index-based crop and livestock insurance* • Inclusive and sustainable social protection transfer including the use of digital fresh food vouchers among PSNP household • Strengthen system for timely and effective shock response including the prevention and treatment of wasting and micronutrient deficiencies

Note: The food systems pathway strategies highlighted in **bold*** have been prioritized by the GoE as requiring exceptionally strong political commitment.

7.3 Synergies and trade-offs

The climate and political risks presented above show the impact of the Ethiopian food systems on the country's socioeconomic development. Improving and addressing the risks may involve trade-offs. For example, efforts to improve the livestock sector can promote increased consumption of dairy, meat and animal products. If consumed in proportion, this could be sustainable for both people and the country's ecology. If not managed properly, the growing livestock sector could not just generate negative environmental impacts, but can also harm the people's health and well-being. Similarly, efforts to improve the production of fruits and vegetable can lead to improved diets. But, if this effort is fueled by increased use of pesticides, additional risks on human health and environment could arise.

Nonetheless, efforts in improving agricultural production through better planning, technology and innovation could promote diverse diets, nutritional outcomes and overall, resilient food systems. To make the food systems in Ethiopia resilient, synergies should be exploited and trade-offs should be mitigated.

8. Needs and Gaps for implementation

Ethiopia has appropriate climate resilience and agriculture strategies in place, along with some structures to support the implementation of these strategies. As noted in the case study, there is a great willingness and commitment from the government to improve the agricultural sector and ensure food security while addressing climate change. Additionally, with existence of large research network, number of CGIAR institutes, NGOs working on climate resilience and agriculture projects, this presents a good opportunity for enhancing Ethiopia's efforts in climate resilient food systems.

Nonetheless, several gaps exist in implementation of climate resilient food systems in the country. Based on the research and discussions with representatives from the Ethiopian government, the following gaps have been identified.

8.1 General gaps in Climate Resilient Food Systems

Building food systems resilience is largely focused on agriculture. Ethiopia's food system is complex, encompassing all the people and processes from the farm all the way through processing, transport, sales, and consumption. The initiatives, national plans, policies lack systemic approaches to address food challenges and effectively managing the risks within the Ethiopian food system is critical to ensuring food security.

Rainfed agriculture dominates the agriculture sector. As the climate changes, there is concern that changes in rainfall amounts and increasing frequency and intensity of droughts will lead to Ethiopia becoming a more food insecure. Irrigation is constrained by the high cost of irrigation equipment, the cost of digging wells, the lack of consistent surface and shallow groundwater, the very high cost of tapping deeper groundwater sources, and knowledge of appropriate irrigation usage/techniques

Ethiopia needs to be supported with approaches for improved agricultural water management such as irrigation to make smallholder farming resilient to adverse weather events. Hence, there is a tremendous opportunity to improve resilience by using smart irrigation systems to harvest and distribute the rain that Ethiopia receives.

Problems with collection of climate data. Despite the growing momentum in climate information initiatives and projects in Ethiopia, there are climate data collection gaps. The Ethiopian Meteorological Institute (EMI), which is mandated with collecting and providing weather and climate information, has identified the that the problem is caused due to the geographically sparse and poorly maintained surface and upper air stations and the underinvestment in satellite data reception and processing systems (WMO, 2011). And, where data does exist, it is often poor or inconsistent quality, limiting efforts for adaptive actions in the face of the varying climate in Ethiopia.

Untapped potential of crop diversification. The diverse agroecological conditions in Ethiopia can enable the country to grow many varieties of crops, cereals, seeds, fruits and vegetables. But, the recurrent exposure to drought shocks have hindered abilities of farmers to diversify crop portfolios. For example, poorer farmers and farming households that lack formal insurance options are more vulnerable to shock exposure, leading them to relying on and using only local seeds as less costly crop options.

Gaps in policy on food systems. The NDC, NAP and other policies and plans currently have little to no consideration towards food systems. Most of the policy documents mention agriculture

production and agriculture emission reduction targets, but ignore the importance of improving food production methods, reducing emissions from livestock, shift to reduce food loss and waste and emissions from food value chains. There is also lack of monitoring and enforcement mechanism for food systems priorities outlined in the national pathway.

Gaps in policy for land use. Smallholder farmers are facing increasing land constraints as farm sizes are declining and younger farmers are increasingly having to rent land to farm with user rights. Ethiopia has no land use policy, as all the land in principle belongs to the state, deterring farmers to invest in long term strategies for climate resilient food systems.

Weak linkages with stakeholders. Studies have found that there is a loose engagement among stakeholders in Ethiopia, like farmers, local institutions, research institutes, others for agricultural knowledge and information system. Involving, engaging, and enabling women and youth in driving and implementing transformative solutions for food systems is also missing. Process for technology and innovation and research is done with limited participation of farmers, as a result of which the research that get conducted and technologies that get developed become unsuitable to farmers leading to little to no adoption (Ministry of Agriculture & Natural Resources, 2017).

Additionally, technology and innovation needs private sector participation. But, the agriculture sector predominantly relies on a government-led system with contribution from NGOs and other actors but limited participation of private sector. For the modernization of climate-resilient farming systems, the input of private service providers is key.

Limited access to improve agricultural knowledge, information, innovation and technologies. Due to limited access to modern agricultural knowledge and information to farmers, there is low adoption of new and improved technologies. Even if technologies are generated, they are often not available to most farmers due to lack of systematic and centralized technology and dissemination mechanisms (Ministry of Agriculture & Natural Resources, 2017).

The country also faces misconceptions and a lack of knowledge surrounding the causes of problems such as droughts and public attitudes and social norms towards new technologies and innovation such as crop diversification are discouraged by the communities.

On the supply-side, small-scale farmers face challenges in accessing affordable and quality inputs such as fertilisers, pesticides and quality seeds. Farmers often lack knowledge of sound soil amendment practices, while extension services have limited capacity and knowledge of horticultural crops (FAO & ECDPM, 2021).

As noted in its food systems national pathway, Ethiopia needs expansion and access to climate resistant crop varieties and seeds, along with increased research into climate smart techniques and technologies, as well as significant extension to increase awareness and uptake of new practices.

Access to finance. Lack of finance has challenged the vast smallholder farmer population in Ethiopia, and prevented the households depending on agriculture to capitalize their farms. For example, irrigation is constrained by the high cost of irrigation equipment, the cost of digging wells, high cost of tapping deeper groundwater sources, and knowledge of appropriate irrigation usage/techniques.

To improve the adoption of some of innovative practices and build resilience, financial mechanisms such as subsidies and agri-finance should assist farmers facing financial constraints by subsidizing the action.

Institutional weakness. Low implementation capacity of institutions, lax system of project administration, monitoring and evaluation; absence of accountability and severe disruption due to instability and conflict have derailed the government’s capacities in harmonized food systems and agriculture policy implementation.

Lack of focus on climate change mitigation. Measuring food systems emissions and developing carbon accounting throughout the whole food system is missing in Ethiopia’s food systems policies and plans. Measuring food related emissions provides a picture of how the evolving food systems is resulting in increased greenhouse gases. This is particularly relevant in Ethiopia for the livestock sector, where a considerable proportion of agricultural emissions emanate and where potential for reduction of agricultural emissions is greatest.

Lack of harmonization in coordination mechanisms. A large number of short-term to medium-term projects are being conducted in Ethiopia in a fragmented manner by a wide number of stakeholders, which could be unsustainable in the long run. Siloed approaches for risk and crisis management have also led to failed interventions. There is a need for harmonization in the approach to climate-smart food systems as well as strengthening of coordination mechanisms.

8.2 Gaps and needs identified in NAP-ETH

The case study notes the key capacity gaps and interventions required for implementation of adaptation options that have been identified by Ethiopia in its NAPs. The table below outlines the capacities needed and interventions in relation to climate resilience in food systems

Table 1: Capacities gap analysis relevant to climate resilient food systems in NAP-ETH

CAPACITIES NEEDED	INTERVENTIONS REQUIRED
Capacity to build and maintain data archives/database on impacts of climate change for agro-climatic zones, vulnerable groups and ecosystems.	<ul style="list-style-type: none"> • Institutionalize the climate change impact database by involving designated data collectors, e.g. the Central Statistics Agency (CSA) and planning bureaus. • Devise Knowledge Management System and institutional memory mechanism for adaptation.
Capacity to run climate models, providing predictions and scenarios, including validation with reference to on-the-ground historical data and level of assessing certainty - at national and regional scales.	<ul style="list-style-type: none"> • Build the capacity of Ethiopia's National Meteorology Agency (NMA) to produce precise and reliable information. • Collect and compile ground data that can augment modeling and scenario building
Capacity to assess status of vulnerability and determine required adaptation responses for the major development sectors and for all agro-	<ul style="list-style-type: none"> • Coordinate vulnerability analysis of sectors and regions, including agro-climatic zones, vulnerable groups and ecosystems.

climatic zones, vulnerable groups and ecosystems.	<ul style="list-style-type: none">• Compile existing vulnerability data/information collected by sectors, regions and non-state actors.
Capacity for enhanced mobilization and involvement of non-state actors including professional societies, development partners and donors.	<ul style="list-style-type: none">• Create strong partnership/network among non- state actors and others.• Involve professionals and civil society actors in adaptation planning, implementation and monitoring.

9. Entry points for the Climate Resilient Food Systems Alliance

The national food and agriculture plans, policies, food systems pathways and food systems summit member states dialogues have shown that Ethiopia is strongly committed to transformation of their food systems. The Climate Resilient Food Systems Alliance stands ready to support Ethiopia's process of food systems transformation, offering knowledge and expertise on topics such as improving policy coherence to advance thought leadership on climate resilience.

Given Ethiopia's vulnerability and less adaptive capacity to absorb external shocks from climate change and variability, along with hazards like drought and floods, the country has prioritized adaptation interventions (Government of Ethiopia, 2021). Effectively managing the risk within the country's food systems is also important. In relation to climate resilient food systems, Ethiopia recognizes that climate resistant inputs, climate-smart technologies, crop varieties, and seeds need to be introduced.

To support the Government of Ethiopia, the alliance brings together a wide range of local partners and utilizes a mix of methods and innovative solutions. For example, the alliance can work with government stakeholders and communities in building projects and programmes in the country with its partners to create reliable climate information for informed decision-making in agricultural practices which will be used to interpret and respond to climate shocks.

On an overarching level, the climate resilient food systems alliance can respond to the needs of the Ethiopian governments to accelerate action on delivering climate resilient food systems through:

- Availing existing methods, climate, food and relevant socio-economic data and information, tools,
 - Identifying appropriate solutions and expertise and promoting knowledge and innovation towards climate resilient food systems in alignment with the country's vision;
 - Collection of possible climate finance sources and guidance on applying to them
 - Create coherence in the NAP priorities outlined for climate resilient food and agriculture with the priorities outlined in Ethiopia's national pathway on food systems.
 - Promoting the alignment of interventions and solutions with countries' needs and priorities through – inter alia - dedicated surveys.
 - Generating evidence and learnings from what is working well and what is not
 - Strengthening integration between different organizations and stakeholders at all levels to improve peer-to-peer exchanges on climate resilient food systems intervention leapfrogging progress
 - Strengthen the coordination among national stakeholders, regional and international counterparts to ensure enhanced implementation, monitoring and evaluation of actions
- On a specific level, the alliance will devise and recommend a suite of tailored solutions for Ethiopia to pick and choose from, which will be aligned to the gaps identified in the previous chapter. The table below outlines the capacities identified in NAP-ETH above and how the climate resilient food systems alliance can mobilize its expertise to advance progress in the specific areas.

CAPACITIES NEEDED	CRFS ENTRY POINTS
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Capacity to build and maintain data archives/database on impacts of climate change for agro-climatic zones, vulnerable groups and ecosystems.	<ul style="list-style-type: none"> • Collection and communication of data to farmers
Capacity to run climate models, providing predictions and scenarios, including validation with reference to onthe-ground historical data and level of assessing certainty - at national and regional scales.	
Capacity to assess status of vulnerability and determine required adaptation responses for the major development sectors and for all agro-climatic zones, vulnerable groups and ecosystems.	
Capacity for enhanced mobilization and involvement of non-state actors including professional societies, development partners and donors.	
Early warning tools	
Policy development, finance, thought leadership, advocacy	

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Annex : Projects on Climate Resilient Food Systems

Organization	Relevant climate resiliency in food systems project (Title + short description)	Location	Beneficiaries	Ministries involved	Partners	Top donors	Focal point
CGIAR	NextGen Agricultural Drought Monitoring and Warning System (NADMWS). Using satellite-based remote sensing technology, combined with detailed land-use maps, seasonal forecasts, national crop statistics, crop phenology and other country-specific data, this system helps to monitor agricultural areas or “hotspots” with a high likelihood of water stress at the national, regional, zonal and woreda (district) levels.	Ethiopia		Ethiopian Ministry of Agriculture (MoA)	AICCRA (led by CGIAR, Biodiversity International and CIAT); Ethiopian Institute of Agricultural Research (EIAR); Ethiopian Meteorological Institute (EMI); Ethiopian Ministry of Agriculture (MoA); International Research Institute for Climate and Society (IRI); FAO; The International Livestock Research Institute (ILRI) under IRI’s Adapting Agriculture to Climate Today, for Tomorrow (ACToday) project.	CGIAR; Federal Government of Ethiopia	Jemal Seid is ACToday Project National Focal for Ethiopia
Ethiopian Agriculture Transformation Agency (ATA)	Agro-Met. The Agro-Meteorology project of the Ethiopian ATA was designed to integrate localized weather and climate information into smallholders’ agronomic practices.	Ethiopia: South West Shoa zone of Oromia region			Federal Government of Ethiopia; Ethiopian ATA	Federal Government of Ethiopia; Ethiopian ATA	

Weather Impacts	<p>Weather Impacts CommonSense. The CommonSense project in Ethiopia targets smallholder farmers in different regions in the country, directly or through actors across their value chain including unions, cooperatives, microfinance institutions (MFIs) and extension services.</p>	Ethiopia: Tigray and Ahmara regions		The Ministry of Agriculture and Livestock Resources (MOALR)	National Meteorological Agency of Ethiopia (NMA); Sesame Business Network (SBN); The Ethiopian Government; the Ministry of Agriculture and Livestock Resources (MOALR)	the Geodata for Agriculture and Water Facility (G4AW) from the Netherlands Space Office; Sesame Business Network (SBN)	Stefan Ligtenberg
PfR: Partners for Resilience	<p>Partners for Resilience. The Partners for Resilience project promotes four building blocks, helping communities to anticipate the risks they face, respond when disaster strikes, adapt to changing risks and livelihood options and address the root causes in implementing disaster risk reduction.</p>	Ethiopia: Somali, Afar, Amhara and Central rift valley			Aged & Children Pastoralis Association (ACPA); CARE Nederland; Ethiopian Red Cross Society; Cordaid; The Netherlands Red Cross; Wetlands; Climate Centre.		partnersforresilience@redcross.nl

WFP	<p>Scaling-up drought anticipatory actions (AAs) for food security in Africa. The AA programme is an innovative approach that enables the implementation and financing of actions before an extreme weather event has occurred. These anticipatory actions aim to prevent and mitigate – to the extent possible – the effects of extreme weather on the food security and nutrition of highly vulnerable people.</p>	Bangladesh, Philippines, Nepal, Mozambique, Dominican Republic, Ethiopia, Somalia, Zimbabwe.			Somali Region Disaster Risk Management Bureau (DRMB); National Meteorological Authority (NMA); Somali Micro Finance Institution and Mercy Corps	WFP	
IRLI/CGIAR	<p>Index-based livestock insurance (IBLI). IBLI is a climate risk financing for the livestock keepers in the drylands whereby insurance products are offered to pastoral communities against drought related risks.</p>	Kenya, Ethiopia			IRLI; CGIAR; Cornell University; Index Insurance Innovation Initiative (I4); Oromiya Insurance Company; Oromia Credit and Saving Share Company (OCSSCO); Oromiya Pastoral Area Development Commission.	USAID – Washington; Index Insurance Innovation Initiative (I4).	

CGIAR	<p>Nexus Gains: this Initiative aims to realize multiple benefits across water, energy, food and ecosystems in selected transboundary river basins, by leading global nexus thinking and providing tools, guidelines, training and facilitation for analysis and research for development.</p>	<p>Central and West Asia and North Africa (CWANA), East and Southern Africa (ESA), South Asia (SA). Prioritized countries: Botswana, Ethiopia, India, Mozambique, Nepal, Pakistan, South Africa, Sudan, Uzbekistan Zimbabwe.</p>			<p>FAO; IFAD; African Union; FECOFUN; SEWA; Zenab for Women in Development; Nile River Basin; Indus; Upper Ganga Basin Organization; Interstate Commission for Water Coordination of Central Asia</p>	<p>World Bank, African Development Bank, IFAD</p>	<p>Stefan Uhlenbrook s.uhlenbrook@cgiar.org</p>
WFP	<p>Satellite Index Insurance for Pastoralists of Ethiopia (SIPE). SIPE provides access to insurance against poor rainfall for vulnerable pastoralists and agro-pastoralists in exchange for contributing to the construction and rehabilitation of community assets in the Somali region.</p>	<p>Ethiopia: Somali region</p>	#5,000		<p>Somali Regional Government; Regional Bureau of Agriculture and Natural Resource Development (BoANRD); Regional Bureau of Livestock Production (BoLP); SNP, Government of Somali Region; WTW; SCOR Mercy Corps; Somali Microfinance Institute (SMFI)</p>	<p>Africa Insurance Company; Ethiopia Insurance Company; Oromia insurance company; Nyala Insurance Company; Somali Microfinance Institute (SMFI).</p>	

IFAD	Participatory Small-scale Irrigation Development Programme II. PASIDP II is a participatory irrigation development project to reduce small-scale farmers' vulnerability to adverse weather conditions by increasing the area of arable land under irrigation.	Ethiopia: Amhara, Oromia, Tigray and the Southern Nations, Nationalities and People's Region		Ministry of Agriculture and Natural Resources; Ministry of Water, Irrigation and Electricity; Ministry of Trade; Ministry of Environment, Forest and Climate Change; Ministry of Finance and Economic Cooperation; and Ministry of Industry	IFAD; Federal Democratic Republic of Ethiopia; Ethiopian Agricultural Research Institute; The Ethiopian Agricultural Transformation Agency; Regional programme coordination and management units (RPCMUs)	IFAD; ASAP Trust Fund; Federal Government of Ethiopia; Rural Poor Stimulus Facility	Ulac Demirag u.demirag@ifad.org William Skinner gb_office@ifad.org
Ethiopian ATA	Integrated Shallow Groundwater Irrigation Development. Developed by the Ethiopian Agricultural Transformation Agency, the Integrated Shallow Groundwater Irrigation Development project intends to enhance smallholder farmers' access to groundwater-based irrigation practices to increase production and productivity of vegetables, field crops, and fodder.	Ethiopia: Oromia, Amhara, SNNPR and Tigray regions			Radar Technologies International (RTI); Addis Ababa University (AAU); AAU School of Earth Sciences.	Agricultural Growth Program (AGP)	
UNDP	Integrated Landscape Management to Enhance Food Security and Ecosystem Resilience. This project intends to enhance long-term sustainability and resilience of food production systems by addressing the environmental drivers of food insecurity in Ethiopia.	Ethiopia: Amhara, SNNP, Oromia, Tigray, Afar and Somali region		Ministry of Environment, Forest and Climate Change; Ministry of Agriculture; and Ministry of Finance and Economic Development	The Government of Ethiopia; the Woreda Agricultural, Water and Energy and Environment Protection and Land Use Offices; Global Environment Facility; other stakeholders: community members and resource users and managers at the local level; NGOs; national and international partners and agencies; universities in the targeted areas; local authorities of Oromia, Amhara, Tigray, Afar	International Fund for Agricultural Development; The Government of Ethiopia	

					and Somali Regional States		
Ethiopian ATA	The Ethiopian Soil Information System (EthioSIS). This project aims to develop soil fertility maps and fertilizer recommendations for each region.	Ethiopia: Amhara, Harari, SNNP, Tigray, Oromia, Afar and Somali regions			The Government of Ethiopia; five farmers' cooperative unions (FCU)	The Government of Ethiopia	
World Bank	SLM II Programme. SLM II is an expansion of the SLM Project, which required to address the serious land degradation that is being exacerbated by climate change.	Ethiopia: Tigray, Benishangul Gumuz, Southern Nations Nationalities and People's Region (SNNPR), Oromia, Gambela, Amhara	421,130 rural households	the Federal Ministry for Economic Cooperation and Development; the Ministry of Agriculture and Natural Resources	World Bank; Federal Government of Ethiopia; Global Environment Facility (GEF); International Development Association (IDA); Federal Ministry for Economic Cooperation and Development; the Ministry of Agriculture and Natural Resources	World Bank; The International Development Association; The Global Environment Facility Trust Fund; The Ethiopia Sustainable Land Management Project Trust Fund.	

World Bank	Food System Resilience Program (FSRP): this project aims to increase the resilience of food systems and its preparedness for food insecurity. The project will assess climate risks to smallholder farmers in the crops and livestock sectors and identify digital adaptation tools that can address the risks and assess opportunities and constraints to their deployment	Eastern and Southern Africa; Madagascar		Ministry of Agriculture and Livestock, Madagascar; Ministry of Agriculture, Ethiopia	Intergovernmental Authority on Development (IGAD); Republic of Madagascar; Federal Democratic Republic of Ethiopia; Center for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA); Ministry of Agriculture and Livestock, Madagascar; Ministry of Agriculture, Ethiopia; IGAD Agriculture and Environmental Division	World Bank; Intergovernmental Authority on Development (IGAD)	
WFP	R4 Rural Resilience Initiative: The Rural Resilience Initiative (R4) is part of the G20 InsuResilience Global Partnership. R4 aims to bolster the Ethiopian agricultural sector with protective measures against climate risk.	Bangladesh, Burkina Faso, El Salvador, Ethiopia, Fiji, Guatemala, Kenya, Madagascar, Malawi, Mozambique, Nicaragua, Senegal, Zambia and Zimbabwe	395,000 (Household reached)	Ministry of Agriculture and Rural Development (MoARD)	Environment, Forestry and Climate Change Commission (EFCCC); Ministry of Agriculture and Rural Development (MoARD); Productive Safety Net Programme (PSNP); Self Help Africa (SHA); Oromia Insurance Company (OIC); Willis Towers Watson; Australian Aid	WFP; Green Climate Fund (GCF)	
CGIAR	Africa Climate security observatory. This project monitors, assesses, and alerts policymakers on the existing and upcoming climate security crises, by generating local, almost real-time evidence to inform timely and responsive decision-making.	Kenya, Ethiopia			CGIAR; The African Union's (AU) Political Affairs, Peace and Security (PAPS); the Department of Agriculture, Rural Development, Blue Economy and Sustainable Environment (ARBE)	Adaptation Fund, Climate Investment Fund, Global Environmental Facility and Green Climate Fund	

Farm Africa	Farm Africa's market Approaches to Resilience (MAR). Part of the UK Government funded BRACED (Building Resilience and Adaptation to Climate Extremes and Disasters) programme; the project aims at address multiple drivers of vulnerability simultaneously, so to increase communities' resilience by increasing their ability to manage their resources efficiently as well as managing daily risks.	Ethiopia: Afar, SNNP and Somali regions	178,620 people (quote)		Farm Africa; Mercy Corps; Lion's Head Global Partners; LTS International Limited; UK Government	UK Government	
CGIAR	Excellence in Agronomy Initiative: The Initiative aims to deliver agronomic gain at scale for millions of smallholder farming households in prioritized farming systems, with emphasis on supporting women and young farmers.	Mexico, Colombia, Peru, Morocco, Mali, Senegal, Ivory Coast, Ghana, Nigeria, Egypt, Ethiopia, Kenya, Uganda, Zambia, Malawi, Democratic Republic of the Congo, Zimbabwe, Rwanda, Cambodia, Vietnam, the Philippines		Ethiopia's Ministry of Agriculture	CGIAR; CIMMYT; academic, training and research partners; private-sector partners; government and other public-sector partners; multilateral organizations; foundations; international, regional, national and local NGOs; and public-private partnerships	CGIAR; Ethiopia's Ministry of Agriculture	
CGIAR	Ukama Ustawi- Diversification for Resilient Agrifood Systems in East and South Africa. this initiative focuses on transforming Africa's agriculture sector through research and promotion of policies, technologies, services and best practices by finding inclusive, scienc-based ways for agribusiness SMEs to support resilient and intensified maize production.	Ethiopia, Kenya, Uganda, Rwanda, United Republic of Tanzania, Mozambique, Madagascar, Zambia, Zimbabwe, South Africa		Ministries of agriculture, green economy, fisheries and livestock, water and the environment	CGIAR; ministries of agriculture, green economy, fisheries and livestock, water and the environment; institutions under the national agricultural research and extension systems; national and regional organizations such as CCARDESA, ASARECA, PABRA, FANRPAN; NGOs; private sector/agribusiness small and medium enterprises; and farmers' organizations, including	CGIAR	

					2-Scale, Briter Bridges, Mercy Corps, Hello Tractor, Mediae, Solidaridad, WorldVeg, and many more.		
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