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FOOD

REIMAGINING AFRICA'S FOOD FUTURE

PATHWAYS TO SUSTAINABLE AGRICULTURE AND RESILIENT COMMUNITIES

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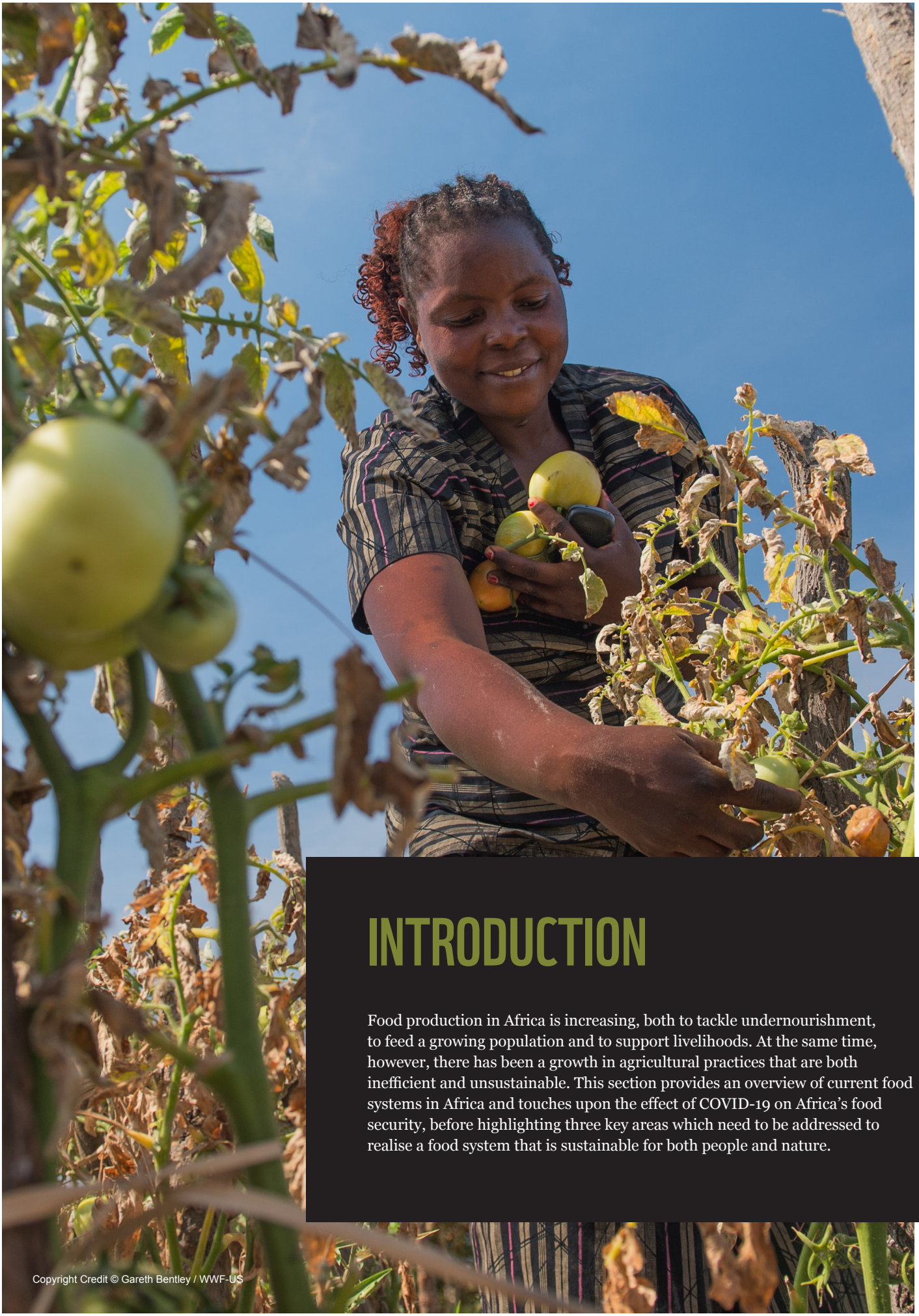

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INTRODUCTION

Food production in Africa is increasing, both to tackle undernourishment, to feed a growing population and to support livelihoods. At the same time, however, there has been a growth in agricultural practices that are both inefficient and unsustainable. This section provides an overview of current food systems in Africa and touches upon the effect of COVID-19 on Africa's food security, before highlighting three key areas which need to be addressed to realise a food system that is sustainable for both people and nature.

THE PURPOSE OF THE PAPER

This paper offers a broad analysis of the factors shaping Africa's food systems, exploring the key drivers that shape their evolution and the limitations of their value chains. From this region-wide analysis, the paper then presents a deep dive into two cross-boundary landscapes, the Kavango-Zambezi Transfrontier Conservation Area (KAZA) and Southern Kenya and Northern Tanzania (SOKNOT), to catalyze discussions on how to achieve nature-positive food production in Africa at the required scale.

In most of Africa, agriculture is the primary source of livelihood and the majority of households consume at least a portion of the food they produce.

This context, layered with the need to transition to healthier diets and accommodate rapid population growth, and dropping yields from unsustainable farming practices, has serious implications for food security. As a result, there is growing pressure to convert more land for agricultural production, further threatening the ecological integrity of the landscapes and the resilience of smallholder farming communities.

This is keenly felt in KAZA and SOKNOT. These landscapes in particular showcase the complex tension point where agriculture and conservation meet. Both landscapes are high-value conservation areas with SOKNOT hosting three ecosystems and the largest and most diverse annual migration of mammals in the world, and KAZA being home to 20 national parks, 85 forest reserves, 22 conservancies, 11 sanctuaries, 103 wildlife management areas and 11 game management areas. Through studying them, we aim to glean important learnings for strategies to reduce human-wildlife conflict and biodiversity loss while enabling sustainable agricultural intensification, alongside alternative livelihoods like sustainable tourism, to deliver benefits to both people and nature.

UNDERLYING ISSUES

The way food is produced, distributed and consumed in Africa is often at odds with the natural capital on which people and wildlife depend. Unsustainable agricultural practices to meet a growing demand for food are threatening ecosystem integrity and resilience. As a result, land is being converted for agricultural use at an alarming rate.

Total arable land in use in Sub-Saharan Africa increased from 133 million hectares in 1961/1963 to 240 million hectares in 2005/2007. By 2050, the Food and Agriculture Organization of the United Nations estimates that this could increase to 291 million hectares [1]. Even though Africa holds 60 per cent of the world's remaining arable land, increased fragmentation of landscapes will have major consequences for wildlife, biodiversity and ecosystem services on which communities depend.

The task of addressing hunger and increasing food demand in Africa is complex and any regional solutions will remain vulnerable to shocks and stresses. Most households throughout Africa depend on agriculture for their livelihood and are both producers and consumers of at least a portion of their own production. The majority of producers are small-scale and they typically sell their crops immediately after harvest, albeit at lower prices, to avoid post-harvest losses. However, unfavourable weather, recurring pest infestations, violent conflicts and economic uncertainty leave these producers extremely vulnerable to shortages and food insecurity.

More than half of the world's acutely food-insecure people live in Africa. With weak growth in domestic production and high rates of food loss, Africa has become a net importer of food. The continent exports $35-40 billion but imports $45-50 billion of agricultural products, along with an additional $6 billion of agricultural inputs [2]. Projected to grow to $110 billion per year by 2025, the increasing reliance on food imports is contributing to rural poverty, unemployment and food insecurity. Every $1 billion spent on food imports is equivalent to the annual income of 334,000 farming households, representing 670,000 on-farm jobs and 200,000 off-farm jobs [3]. Internal and external economic and agricultural policies, such as taxation on food production within Africa and select subsidies from developed countries, have contributed to a growth in unsustainable production practices. Such practices are not viable in the long-term, ultimately exacerbating poverty and limiting food security.

COVID-19 has increased this vulnerability. Countries closed their borders, cutting off food imports on which many parts of Africa depend. Movement restrictions within Africa have hampered the flow of goods from smallholder farmers to markets and vice versa. Furthermore, the suspension of operations by seed producers and anxiety over travelling to markets for fear of contracting the virus have meant that many farmers have been without the necessary inputs for the planting season. These compounding factors have resulted in diminished food availability and increased food insecurity across the region, while future outputs could be vastly insufficient following the failures to plant and harvest.

In a speech at the UN Security Council meeting titled "Maintenance of International Peace and Security: Protecting Civilians Affected by Conflict-Induced Hunger," Executive Director of the UN World Food Programme (WFP) David Beasley shared that COVID-19 disruptions could double the number of people with severely limited access to nutritious food, bringing the number to 265 million globally [4]. Additionally, the WFP estimates that since February 2020, approximately 12 million people have been pushed into acute food insecurity in Sub-Saharan Africa [5].

Urgent action must be taken in order to save lives and livelihoods during this time of difficulty. Food aid must be preserved and stimulus and relief packages need to reach the most vulnerable. Food and nutrition should sit at the heart of social protection programmes and health system responses for nutritional care must be strengthened. The current pandemic highlights the need for such actions, but they cannot be part of a short-term response to an impending food crisis. Beyond the immediate actions, there is an opportunity to redesign food systems so that they are both resilient and sustainable, working with, rather than against, nature. This is particularly true in Africa.

Now more than ever is the time to investigate tailored solutions to support the sustainable evolution of Africa's food systems, covering the full spectrum of drivers from climate change through to governance and the outcomes that shape the future of food in the continent.

OPPORTUNITIES FOR CHANGE

The various actors that influence Africa's food system (including producers, consumers, development organisations, research institutions, companies and governments) are deeply intertwined.

As such, the issues described in this report cannot be fixed in silos. For example, the lack of sustainable farming technologies cannot be discussed without critiquing land use policy, and the issue of soil degradation must be tackled with an understanding of the domestic and export market for staple crops. In order for Africa to realise a food system that is sustainable for both humans and nature, various dimensions of the food system must be transformed. Three key areas to investigate as a starting point include the need to:

RETHINK LAND USE

The conversion of land to accommodate the expansion of agriculture is the most significant cause of ecosystem disruption and biodiversity loss. It should be addressed head on. The success of existing transfrontier conservation landscapes, such as in the Albertine Rift and Kilombero Valley Ramsar site, that demonstrate effective integrated land use planning to protect nature and promote sustainable agriculture, could inform similar implementations in SOKNOT and KAZA. Local authorities would benefit from tailored support while assessing land use plans to understand their effectiveness and food footprint, as well as strategies to incorporate sustainability for food systems into these plans and effectively manage their implementation.

REFRESH FARMING PRACTICES

Soils are becoming depleted of organic content due to over-planting, overgrazing and a lack of regenerative farming practices. The result is reduced agricultural productivity and growing pressure for land conversion. There is merit in exploring different approaches to sustainable agriculture, such as agroecology, which seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that can help shape a sustainable and fair food system [6]. For widespread adoption of such practices, there needs to be clear benefits for players on the ground, namely smallholder producers. It will be imperative to present compelling evidence of the long-term potential of sustainable farming practices to improve profits and livelihoods as a comparison to the detrimental effects of holding onto conventional methods.

RE-ENVISION THE VALUE CHAIN

Some of the biggest challenges with the current value chain are low agricultural productivity, an over-dependence on a few staple crops (e.g. maize , sorghum) and high food loss due to poor storage options. Despite the fact that these issues perpetuate a low return on investment for smallholders, they and other actors along the value chain have little incentive to invest in sustainable practices. A first step in re-envisioning the value chain could be to establish a network of support to provide access to the relevant expertise. For example, development partners could come on board to pilot models of sustainable value chains for smallholders. Additionally, companies could partner with farmer groups to facilitate direct and sustainably-minded commercial relationships that put the farmers' interests first, with support measures in place to ensure fair and on-time payments and decrease post-harvest losses.

THE BIG PICTURE - UNDERSTANDING AFRICA'S FOOD SYSTEMS

The dual challenges of feeding everyone in Africa and conserving nature often involve trade-offs. This section provides an overview of the environmental impacts poorly planned and managed food systems can have in Africa.

FEEDING A CONTINENT WHILE CONSERVING NATURE

From the way crops are grown to the moment they reach the end consumer, every transaction in the value chain has implications for the natural environment and conservation efforts.

Food systems across Africa, where not well planned and managed, are invading and degrading forests, savannahs and wetlands, as well as polluting water, "mining" soils and producing greenhouse gases in ever-increasing amounts. In many places, harmony has not been achieved between conservation and food production. Here are the key environmental challenges associated with Africa's food system:

BIODIVERSITY LOSS

The food system affects biodiversity in different ways. Firstly, in the range and variety of crops produced, as well as the types of agricultural and fishing practices that are employed. Secondly, in terms of its impact on the natural landscape on which food is grown. Agriculture can result in biodiversity loss for a number of reasons:

- Land conversion, with the complete removal of native vegetation, for monocultures. High yielding crop varieties generally need to be planted as monocrops to achieve their yield potential, which in the short-term is likely to be higher than diverse systems. Mono-cropping requires less management and cost than multiple or mixed cropping. The lack of market information and financial incentives is another reason farmers are less likely to plant a more diverse range of crops.
- A lack of land-tenure rights for women despite the fact that they make up the bulk of the actively productive population in rural communities. In Cameroon, for example, this is reported to be a driver of biodiversity loss [7]. Security of tenure is key to having control over major decisions such as which crops to grow and which techniques to use. If tenure is secure, a farmer can invest in the land's productive potential and is more likely to adopt environmentally sustainable farming practices [8].
- Increasing use of agrochemicals reduces insects and other natural pollinators and predators, both within and around the cultivated area. Agricultural run-offs causing aquatic pollution also has implications for water quality and the health of fish populations.
- Indiscriminate overfishing leads to harvesting of immature and rare species of fish and other marine animals. Although policies and regulations are in place to reduce overfishing, and technologies are available for more selective fishing methods, there is little government capacity to monitor and enforce them.

WILDLIFE CONFLICT

Competition for grazing land and forests, as well as the domestic and international demand for bushmeat, have become an existential challenge facing the conservation of large mammals in Africa. The key factors include:

- Killing of wildlife around agriculture communities to protect crops and livestock and ultimately, livelihoods
- Land use change for agriculture is increasing, which in turn disrupts wildlife movement through fencing and other protective strategies. In some areas of South Africa and Zimbabwe, baboon populations have dwindled particularly where they've come into conflict with commercial agriculture, to the extent that the current distribution of baboon is largely restricted to areas where subsistence agriculture is practised, posing a threat to smallholder farmers [9].
- Changes in land management and ownership is leading to the disruption of wildlife corridors and general freedom of movement. This is particularly prevalent in countries such as Kenya, where policy reforms to address land disputes are increasing private land ownership.

LAND CONVERSION

Deforestation, drainage of wetlands and invasion of grasslands is occurring as a direct result of food production. These include:

- Increasing agricultural production. In SOKNOT and KAZA, this has increased by up to 18 per cent over the past 20 years due to both land expansion and conversion. Across the continent, increased production is driving

deforestation and conversion. In 2018, Cameroon and DRC alone lost 539,183 hectares of primary rainforest, with 75 per cent estimated to be caused by small and medium-scale farming activities.

- Decreasing yields due to soil degradation and rising pest pressure are driving the demand for land conversion. In Zambia, yields of maize, the dominant food crop, fell 7.4 per cent between 2012 and 2017. Similar trends are occurring in most African countries.
- Increasing large-scale ranching operations to meet the growing demand for meat and milk across the continent [10]. This is prompting smallholder farmers to install fencing and other support structures to protect their livestock. As a result, wildlife is being diverted from its natural migration and dispersal areas. At the same time, many of these facilities are being constructed with timber extracted from natural landscapes.

WATER QUALITY AND DEPLETION

Rainfall distribution across Africa is uneven, with 86 per cent of water withdrawals directed towards agriculture. This percentage is even higher in the arid and semi-arid parts of the continent [11], such as SOKNOT and KAZA. Traditional water sources, including rivers, seasonal streams and shallow wells, are drying up in some areas and many current agricultural practices are having a detrimental effect on water quality. These include:

- Growing demand for irrigation and water as more farmers turn to higher value dairy and horticulture products to meet basic income needs. In Tanzania, horticulture is the fastest growing agriculture sub-sector, generating $642 million in 2016, up from $64 million 10 years earlier.
- Increasing availability of affordable technologies such as water pumps and irrigation equipment. In SOKNOT, the ability to extract larger amounts of water enables farmers to plant high demand crops such as tomatoes and onions along river banks and lakes.
- Expansion of agricultural production into new areas is causing rural water sources to be contaminated with human and animal waste. Dust from eroded soils can also be a significant contaminant in savannah areas dedicated to the production of annual crops.
- Run-off from fertilizers are fuelling the rapid growth of algae in aquatic ecosystems and in many cases, creating anaerobic conditions leading to complete ecosystem breakdown. In the Greater Virunga landscape, considerable mortality of the Nile Perch in Lake Albert is due to eutrophication, which occurs when a body of water becomes overly enriched with nutrients and minerals. Similar examples are widespread across other fresh water bodies in Africa, such as Lake Victoria. Run-off from pesticides can also have equally damaging

effects over the long term when residues enter human and wildlife food chains via water, albeit gradually and in a less visible manner.

- High rates of topsoil loss are contributing to downstream sedimentation and degradation of local and regional water bodies. In Tigray, Ethiopia, reservoirs designed to improve water access with a 20-year lifespan, lost half of their storage capacity in only five years due to sedimentation [12].
- Over-extraction of water for irrigation from wells and boreholes and the failure to maintain drainage channels in irrigation systems is causing issues with water salinity, which can affect crop yield.

SOIL DEGRADATION

Many soils being used for crop production are low in organic matter. Approximately 25 per cent of soils in Africa are acidic, and therefore deficient in phosphorus, calcium and magnesium with often toxic levels of aluminium [13]. This affects crop yield and the ability to regenerate a biodiverse range of natural species. Key challenges include:

- Continuous cropping and ploughing of soil without the addition of organic manure or mulch has gradually reduced its natural organic content. This is especially important in areas threatened by drought and malnutrition.
- Mono-cropping over a period of years without rotation has accelerated the removal of micronutrients and the build-up of pest species specific to the crop being grown. In the case of staple food crops, the consequent reduction in yields can threaten food security.
- Clearing of perennial shrubs and trees to create fields for annual crops has eliminated the natural recycling of organic matter from vegetation and the translocation of minerals and micronutrients into the top soil from deep root systems.
- Application of inorganic fertilizers has increased soil acidity leading to micronutrient deficiency and even toxicity which inhibits normal growth. Fertilizer use is increasing; for instance. In SOKNOT and KAZA, it doubled in the 10-year period between 2006 and 2016.
- Poor cultivation including a lack of terracing or contouring, and the removal of perennial vegetation has accelerated soil erosion.
- Repeated ploughing coupled with minimal ground cover strategies to manage soil erosion and quality has accelerated the breakdown of organic carbon, leading to increased carbon.

AIR QUALITY AND POLLUTION

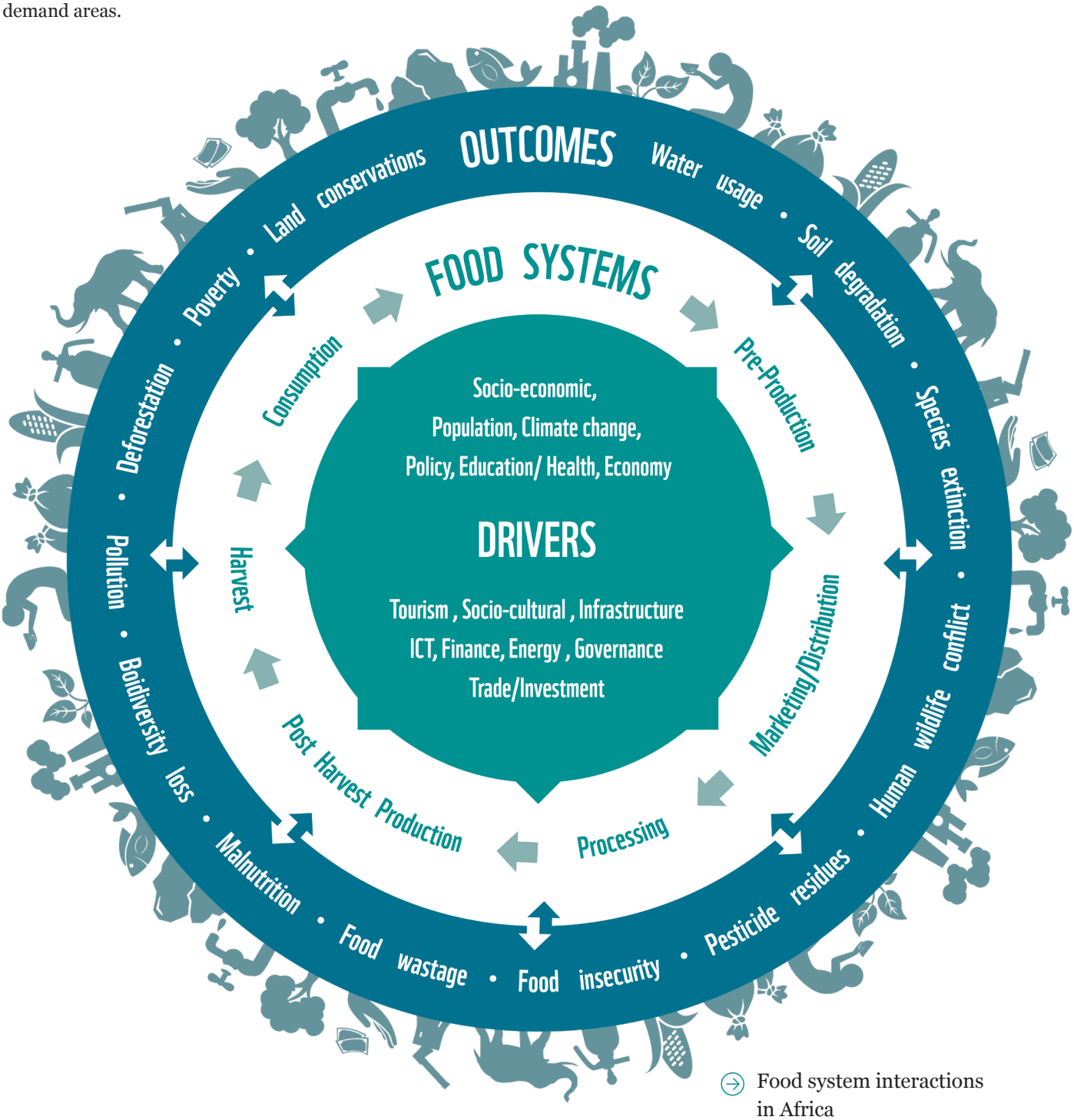
Food systems affect air quality in two distinct ways: emission of greenhouse gases (GHGs), mainly carbon dioxide and methane; and the production of air-borne pollutants, particularly exhaust fumes and microscopic particles that are toxic to both human and wild populations and, in some cases, vegetation and crops. The main factors affecting air quality include:

- Loss of trees and vegetation coupled with intensifying livestock practices contribute to GHG emissions.
- Livestock emissions from traditional herding and pastoralism generally have a low carbon footprint and a positive recycling effect on soil organic matter and nutrients. However, ranching and intensive production using industrial feeds and zero-grazing practices will, in the future, produce higher quantities of GHGs and organic waste that cannot be easily recycled.
- Transportation of food in diesel and petrol-fuelled vehicles leading to hydrocarbon emissions. Although this is not significant at the moment, the quantity of high-value fruits, fresh produce and fish being air-freighted daily to export markets is steadily increasing.

FOOD SYSTEM DRIVERS

Although Africa is a net food importer, the food needs of many African populations are largely met through local crop and livestock production.

This is supplemented by trade within and between markets (of approximately $8 billion of food agricultural products [14]) connecting the regions to surrounding production and demand areas.



Food system interactions in Africa

The three key trends impacting the evolution of food systems in Africa are:

DRIVER 1: POPULATION GROWTH

Current growth rates of nearly 3 per cent per annum project a population of 2.5 billion people in the continent by 2030. The fast-growing population and corresponding rise in the demand for food is the most significant driver of the food systems in all parts of the continent.

In addition, rapid urbanization is a trend that is expected to intensify as more people make the move from rural areas that are underserved by infrastructure and investment [15]. The move to cities is also shifting consumption toward foods with higher environmental impact, particularly meat, milk, fish and processed products.

DRIVER 2: CLIMATE CHANGE

Climate change is already significantly impacting Africa's food systems. Production is heavily dependent on rain and weather patterns, which are becoming more variable and with greater extremes. The frequency and intensity of extreme weather events, especially droughts, are increasingly causing total crop failure for many farmers, leading to food insecurity and loss of income. Rising global temperatures are changing agro-ecological conditions, which can result in pest infestations, further exacerbating losses in food production.

DRIVER 3: LAND USE CHANGES

The way land is used is shifting to accommodate agricultural growth. Land fragmentation is breaking up wildlife dispersal areas as land is increasingly divided to accommodate the growing human and livestock populations. In Kenya especially, this is being reinforced through policy reforms. The expansion of grazing land is putting livestock in direct competition with wildlife for resources, and deforestation and conversion to make way for planting fields and livestock ranches is widespread.

VALUE CHAIN ANALYSIS

Food production practices currently used for farming, fishing and livestock management in Africa are arguably the biggest contributor to landscape shrinkage and degradation.

UNSUSTAINABLE PRODUCTION PRACTICES

Unsustainable production practices are widespread. Agriculture is generally low-input, manual and labour-intensive. The use of agrochemicals is low but increasing, often without clear awareness of the substance being applied, its effects on soils and human health, the correct rates of application and cost-effectiveness.

YIELDS ARE DECREASING

Yields are decreasing and this can be attributed to soil degradation, lack of labour-saving technologies and rising pest pressure. These factors hinder effective plant growth, limiting the economic yields of crops and the regeneration of a biodiverse range of natural species. Pressure for land conversion is increasing despite efforts by government and development agencies to increase the agricultural productivity of existing farmland. Efforts to introduce more sustainable farming practices such as conservation tillage have had limited success, mainly due to the costs of conversion from current practices.

FOOD LOSSES ARE HIGH

Post-Harvest food losses are high due to low storage capacity, lack of know-how on produce handling and preservation, and lack of infrastructure for aggregation, storage and distribution. Estimates indicate that between 10 per cent and 40 per cent of cereal production is lost after harvest [16], with livestock post-slaughter wastage even higher due to unsanitary handling and processing, lack of clean water and the absence of refrigeration. Within fisheries, high post-harvest losses occur due to delays in the transport chain and non-existent or low-quality cold storage facilities.

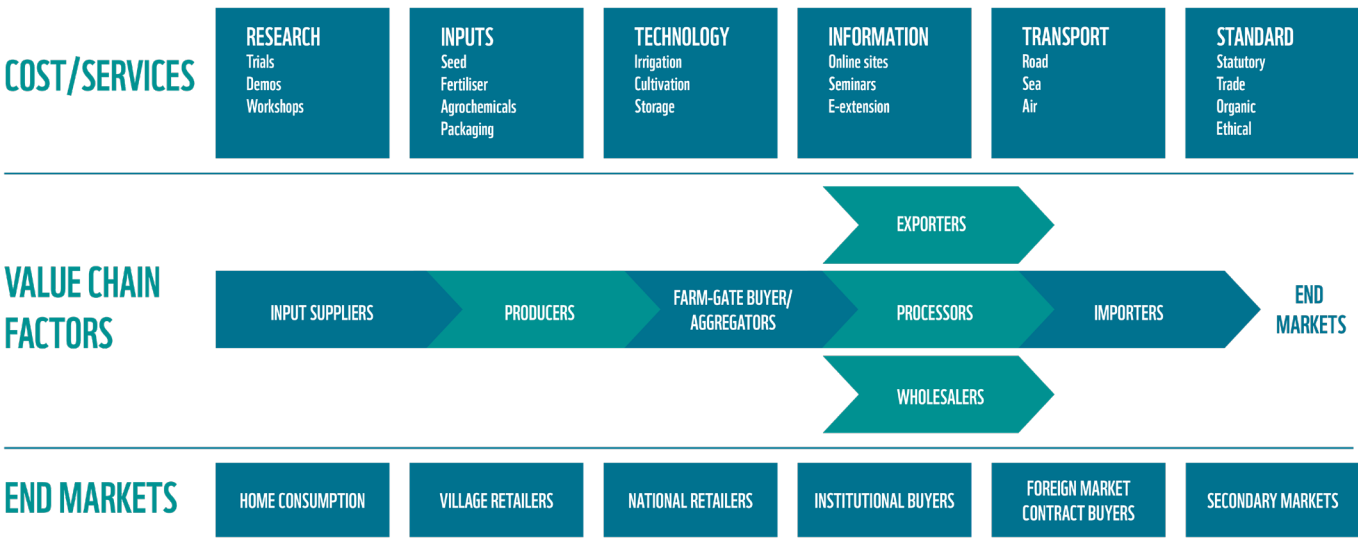
SUPPLY CHAINS ARE SHORT

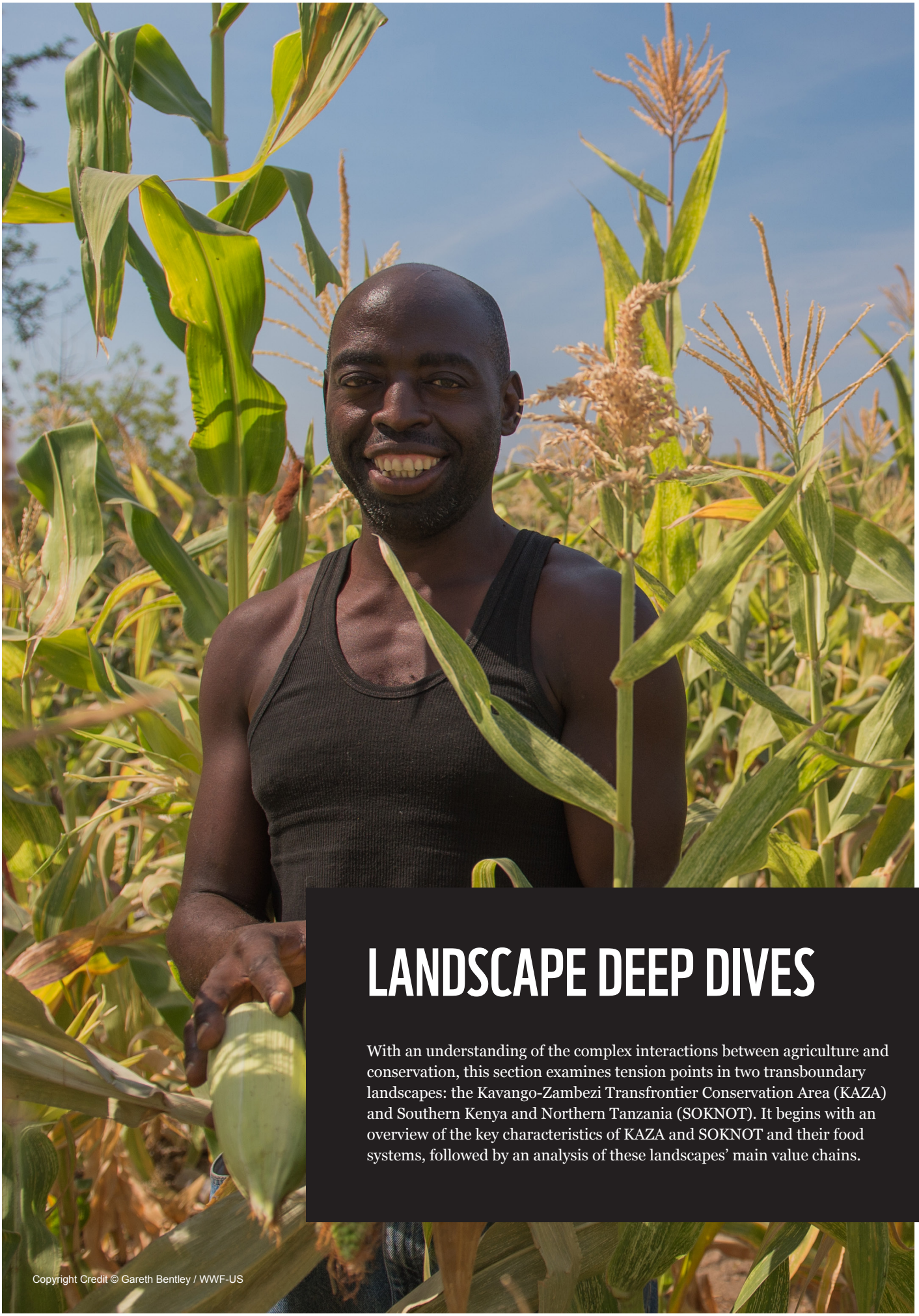
Supply chains are short, primarily supplying households and local markets. Most households throughout Africa depend on agriculture for their livelihood and consume at least a portion of what they grow. The majority of producers are small-scale and they typically sell their crops immediately after harvest, albeit at lower prices, to avoid post-harvest losses.

VALUE CHAIN INTERVENTIONS

Value chain interventions have not resulted in equitable value distribution. Consequently, producers, aggregators and traders are currently not incentivized to adopt more sustainable practices such as diversifying crops, reducing post-harvest losses, investing in solar technology and adopting integrated pest management techniques.

THE VALUE CHAIN NETWORK





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LANDSCAPE DEEP DIVES

With an understanding of the complex interactions between agriculture and conservation, this section examines tension points in two transboundary landscapes: the Kavango-Zambezi Transfrontier Conservation Area (KAZA) and Southern Kenya and Northern Tanzania (SOKNOT). It begins with an overview of the key characteristics of KAZA and SOKNOT and their food systems, followed by an analysis of these landscapes' main value chains.

SPOTLIGHT ON KAZA

The Kavango-Zambezi Transfrontier Conservation Area (KAZA) is the largest of its kind in the world. Crop production is predominated by smallholders who rely on subsistence farming. Faced with rainfall constraints, the majority of KAZA suffers from low agricultural productivity. There is opportunity to adopt agroecological practices to safeguard against climate change.

OVERVIEW

The KAZA transfrontier conservation area covers nearly 520,000km², encompassing most of the Okavango and the Upper Zambezi River Basins. It includes three UNESCO World Heritage Sites: the Victoria Falls, the Okavango Delta and the Tsodilo Hills. KAZA is a mixed land use landscape with only 20 per cent of the land under full state protection and about 29 per cent available for agriculture use. The area comprises 20 National Parks, 85 Forest Reserves, 22 Conservancies, 11 Sanctuaries, 103 Wildlife Management Areas and 11 Game Management Areas. Approximately 70 per cent of the land is under some form of wildlife management, with the rest used for agriculture and livestock.

Population in the landscape is estimated at 2.7 million people, most of whom live within the areas not demarcated for wildlife conservation. These communities are typically poor, with a relatively small number of people directly benefiting from the tourism industry. The most vulnerable communities rely on subsistence farming, frequently clearing trees for crops and fuel and hunting wildlife illegally for food and bushmeat trade.

In Zimbabwe, the KAZA region lies within Matabeleland North and Mashonaland West, classified as Natural Regions IV and V, comprising some of the country's least fertile land. While not suitable for dryland cropping, the regions have adequate rangeland for livestock production. Despite these conditions, the majority of smallholder farmers in Zimbabwe are located in Regions IV and V, where they grow maize, sorghum, pearl millet and finger millet. Crop failure rates are high and average yields are low even in years when rainfall is adequate, since most farmers lack consistent access to technical information and affordable inputs appropriate to the conditions.

In Zambia, KAZA cuts across five provinces, falling mainly within Western and Southern Provinces, classified as Agroecological Regions I and II. In Region I, farmers grow primarily maize and sorghum. They also raise chickens, goats and sheep, cattle and pigs. Region II is characterized by fertile soils and is home to most of the country's commercial farms. Farmers in this region grow maize, cotton, tobacco, sunflower, soybean, irrigated wheat and groundnuts, with some cattle and poultry production. Agriculture is dominated by smallholder farmers but larger commercial farms are also present in areas where relatively high rainfall and good soils provide the potential for competitive yields.

57%

OF GLOBAL CASSAVA PRODUCTION IN 2017 WAS ACCOUNTED FOR BY AFRICAN COUNTRIES

THE FOOD SYSTEM IN KAZA

In the KAZA landscape, the main livelihood strategy is subsistence agriculture where the major constraint is rainfall. Climatic trends for rainfed agriculture are concerning and are likely to be to be prohibitive for current agronomic practices.

In Zambia, a reliance on maize production in sub-optimal environments, lack of crop diversification, low- or poor-quality inputs and lack of mechanization and precision technologies have resulted in low productivity. This is reinforced by government subsidy programmes that provide for artificially low prices for seeds and fertilizers. As a result, the development of alternative value chains better suited to the agro-ecology of the region has been slow to catch on. This has long term implications across the value chain, from malnutrition due to low dietary diversity to ineffective pest management due to mono-culture cropping practices.

On the flipside, crops like sorghum and millet, while not as widely adopted yet, are emerging as food crops in their own right because of their high potential in areas affected by climate change. Unlike maize, these small grain cereals have significant tolerance for heat and drought and are well adapted to produce a crop in marginal semi-arid environments with low and erratic rainfall.

The KAZA regions in Namibia, Botswana and Zimbabwe suffer from low agricultural productivity and therefore rely on cereal imports for food security. This makes them vulnerable to global food prices, which have been rising substantially since 2003. The only course of action they can take in response to increasing prices is to either expand the area under production or intensify cultivation in order to meet family food demand. Both reactions carry inherent threats to the natural landscape.

VALUE CHAIN DEEP DIVE

Crop production systems are primarily based on subsistence principles to supply enough food for household consumption, as well as occasional sales to neighbourhood markets if surpluses are generated or there is an urgent need for cash. Agricultural practices are generally low input and labour-intensive, with little use of data to inform soil analysis, weather forecasting or market prices.

PRE-PRODUCTION

Pre-production in KAZA is characterised by low and decreasing rainfall and poor soil quality, largely comprising Kalahari sands which are acidic and highly leached, with poor water retention capacity. In Zimbabwe, while 82 per cent of total water withdrawn is for agriculture, the majority of rural communities have no access to bulk water storage or irrigation. Less than 3 per cent of arable land is irrigated on a regular basis. The few boreholes available for households or livestock in the area often dry up during droughts or extended dry seasons. In contrast, Zambia lies on two large river basins and wetlands cover about 5 per cent of the land area, which is

critical for fishing, livestock watering and vegetable growing. Farmers tend to use grain from the previous season as seed. There is also low or inefficient application of compost, manure or inorganic fertilizer.

CROP PRODUCTION

Crop production in KAZA is predominated by smallholders. Given the available household labour of a typical family [17], most work with less than 5 hectares of arable land on average. Increased access to land would therefore not benefit most households unless hired labour becomes available at a relatively low cost. Smallholders work on subsistence principles, minimizing the cost and risk of purchased inputs and planting just enough for household consumption plus a little extra for opportunistic sales. A key yield constraint for smallholders is the cost and inefficiency of manual weed control. Pests and plant diseases also pose challenges during production.

LIVESTOCK PRODUCTION

Livestock production in KAZA is extensive and reliant on rangeland grazing. There is a shortage of grazing material and nutrients to support the livestock population. Feed supply is sourced from plant residues from cereal and legume production. Much of the KAZA landscape in Zimbabwe is not suitable for crops. Rather, it supports a resident population of livestock-based households, surviving on low yields of food crops supplemented by milk and occasional sales of meat from small herds of cattle and goats. Households plant cereals and legumes, often harvesting minimal amounts of grain and beans for consumption but producing plant residues for livestock feed.

FISHERY PRODUCTION

Fishery production in KAZA is in decline. In the Zambezi/Chobe system, catch per unit effort dropped significantly from 1997 to 2015. Production from capture fisheries is not likely to increase since they are already over-exploited. Research and management on the overall health of fisheries is insufficient. An influx of illegal fishermen, lack of resources to monitor illegal fishing activities and the increasing use of illegal fishing methods exacerbate the lack of community engagement.

HARVEST AND POST-HARVEST

Harvest and post-harvest activities, such as the threshing and drying of maize and legumes, are carried out manually by smallholders. This leads to sub-optimal quality, poor storage potential and sometimes contamination of grains. Post-harvest losses are large with households storing in polyfibre gunny bags, outside stores or in open piles with no protection. There is some use of post-harvest insecticides in an attempt to reduce post-harvest losses but these are generally unreliable, dangerous to health and unpopular. On the upside, hermetic storage bags that restrict oxygen permeability have emerged as a cost-effective method of minimising insect damage and retaining food quality. Introduced in 2006, the bags have seen high levels of adoption among smallholder farmers. Within fisheries, high post-harvest losses occur due to delays in the transport chain and quality of cold storage.

MARKETING AND PROCESSING

Marketing and processing activities are informal and unregulated in local markets. Most farmers have no information or ability to influence prices and generally sell produce because of immediate cash needs for household supplies, school fees or health care expenses. Participating as individuals in the market, they face high expenses due to lack of aggregation and poor road and transport infrastructure. Smallholder farmers are unable to sell produce at higher prices and are disincentivized from diversified crop production.

CONSUMPTION

Consumption is characterized by low dietary diversity, low protein consumption and macronutrient deficiencies, especially in Zambia. Promotion of nutrition-sensitive approaches to agriculture and education for behaviour change have not been a priority in the KAZA areas. However, a gradual shift is underfoot. Zambia launched its Second National Agricultural Policy in 2016, which aims to promote agroprocessing, preservation and utilization of nutrient rich food [18]. This may stimulate demand towards some of the more climate-resilient small grains.

TOP THREE STAPLE FOODS PRODUCED IN THE KAZA REGION IN 2017

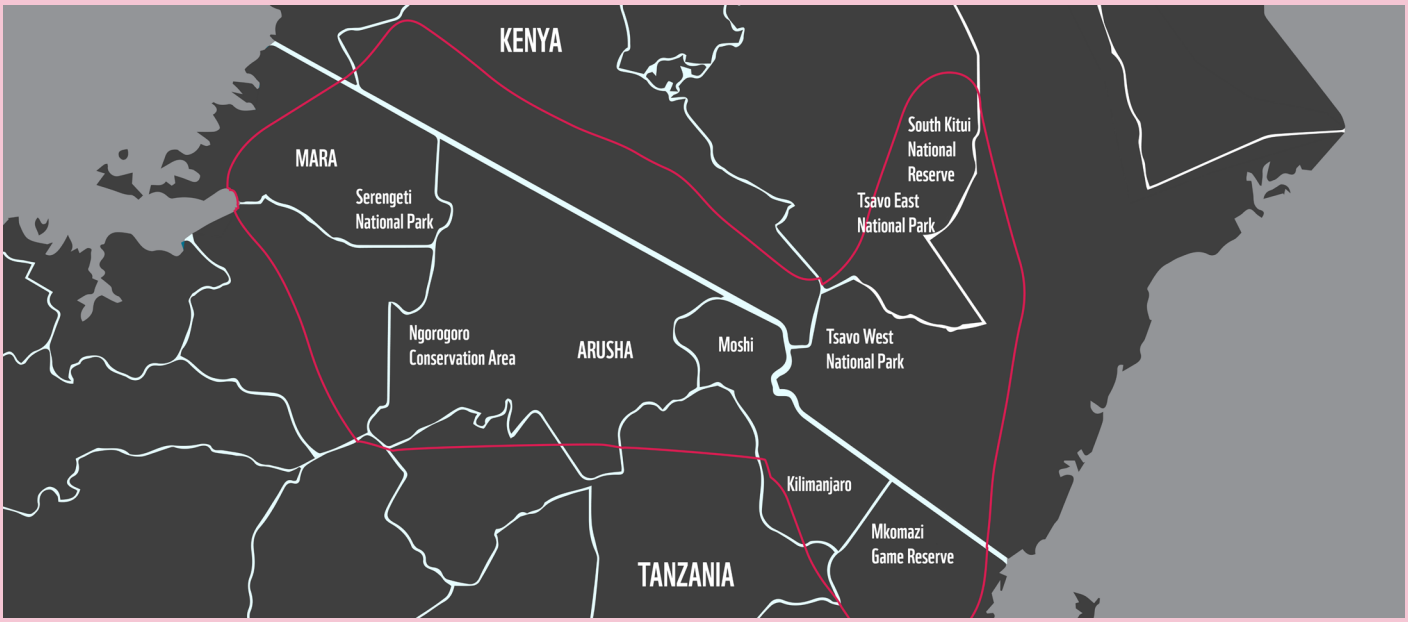
9M METRIC TONNES CASSAVA

6M METRIC TONNES MAIZE

4M METRIC TONNES BANANAS

SPOTLIGHT ON SOKNOT

The Southern Kenya Northern Tanzania (SOKNOT) landscape covers 159,153km2 in the transboundary region of Kenya and Tanzania. Here, biodiversity is facing challenges due to intensive production practices and mono-cropping due to a government subsidization of seeds for maize. There has not been a formal transboundary institutional framework established, leaving an opportunity for a landscape wide food system and conservation initiative.



OVERVIEW

The SOKNOT landscape is home to three ecosystems: Mau-Mara-Serengeti, Amboseli-West Kilimanjaro and Tsavo-Mkomazi connected by wildlife migratory corridors and dispersal areas. It is the site of the largest and most diverse annual migration of mammals in the world and includes areas of global significance including two UNESCO World Heritage sites (Serengeti and Mt. Kilimanjaro). The SOKNOT landscape also contains the Mau Forest Complex, the main watershed and source of water for the population of western Kenya. As it is not a State-defined transboundary area like KAZA, SOKNOT-specific data is limited. Therefore, some of the information in this section is related to Kenya and Tanzania more broadly.

SOKNOT is made up of eight state-managed protected areas and 32 community-managed conservation areas, which are critical for the movement of wildlife between the countries. The SOKNOT landscape contributes $3.2 billion annually to the economies of Kenya and Tanzania through wildlife tourism, while providing an estimated 3 million jobs and $10 million to community conserved areas.

Population in the landscape is estimated at between 3 and 4 million people, with pockets of high population density and sparsely populated expansive areas of rangelands. In Kenya, SOKNOT encompasses Narok, Kajiado and Taita Taveta Counties, which are classified as Arid and Semi-Arid Lands, with annual rainfall ranging between 200 and 850mm per year. In Tanzania, the regions of Mara, Arusha, Kilimanjaro and Tanga, which fall within the Northern and Lake zones, are characterized by rainfall ranging from 450 to 1200mm per year, with soils variable in texture and susceptible to water erosion. Small parts of the region, at the foot of Mt Kilimanjaro, receive higher amounts of rain (up to 2,000mm) and soils are moderately fertile on the higher slopes. For the majority of the landscape, smallholder farmers subsist on production of staples including maize, beans, cassava and other grains and legumes such as sorghum and cowpeas.

Agriculture is the central component of economic growth in SOKNOT. In Kenya and Tanzania, 80 per cent of the population rely on agriculture to earn a living and the food needs of the population are largely met through local crop and livestock production, supplemented by trade.

THE FOOD SYSTEM IN SOKNOT

SOKNOT's food systems are diverse, including areas of intensive crop production as well as large tracts of rangelands, where livestock are the main source of food and income. Although the landscape has a strong subsistence component, a localized market economy exists and food is purchased, both from nearby sources and imported from neighbouring regions and counties. Pastoralists are increasingly purchasing food and many rely on food aid, which further alters their mobility and contributes to the rise in sedentary agro-pastoralism, a combination of farming with a pastoral component. Moreover, growing urban demand for food and agricultural products coupled with resource depletion are leading to an expansion of commercial agriculture into SOKNOT.

Both Kenya and Tanzania have strong export industries for a wide range of agricultural commodities, some of which are grown within the landscape. Although the export business creates new economic incentives for cash crops, stringent quality and price competition in export markets are leading to intensive production practices that can impact biodiversity. Moreover, in the case of horticultural produce, rapid turnover of short-term crops prevents soil regeneration and natural pest control from crop rotation, and competes for land use with the staple crops that fulfil local consumption.

The staple foods produced in the SOKNOT landscape are maize, cassava, sweet potatoes, rice, potatoes and banana. In addition to these, several other crops are grown in smaller quantities or in confined geographies. For example, wheat in Narok County is produced by large-scale commercial farmers, while coffee (Arabica varieties) is grown for export in Kilimanjaro and around Serengeti, where it is the primary cash crop. Tomato and onion are grown on both sides of the landscape, and in Arusha and Kilimanjaro regions high value crops like green beans and peas, berries and herbs generate exports of more than 10,000MT/per year.

VALUE CHAIN DEEP DIVE

The majority of value chains within the SOKNOT region, such as for production of food crops for home consumption, are based on short supply chains. Others, such as vegetables for export to Europe, involve multiple processes, long distance transportation and other commercial services that can increase the farm-gate value by ten-fold or more by the time they reach the final consumer.

In the pre-production stage, staple crops are considered low value and receive minimal application of fertiliser and water. Horticultural crops and dairy farms that are deemed to be higher value receive higher inputs as they are expected to net higher returns. Seeds for staple crops like maize are also more available because they are a "high response" crop with the potential to produce high yields with sufficient rainfall and input. However the side effects of government subsidization of seeds for maize include biodiversity loss from mono-cropping and an inadequate supply of seed for other food crops.

9,125,737

METRIC TONNES MAIZE PRODUCED IN KENYA AND TANZANIA 2017

Farmers tend to keep grain to reuse as seed year-on-year, reducing the yield potential and pest-resistance capacity over time. The availability of new seed varieties is also limited, especially in rural and remote areas. Development projects and government initiatives have promoted improvement of livestock breeds, artificial insemination of cattle and herd management techniques in pastoral areas to reduce overstocking but adoption rates are low or negligible.

CROP PRODUCTION

Crop production in SOKNOT is largely rain-fed and manual. The farming population is predominantly smallholder, making up 63 per cent and 69 per cent of food production in Kenya and Tanzania respectively. Average households grow a limited number of crops, and farming practices are generally manual with almost no use of precision techniques based on soil analysis or pest risk assessment. The selection and application of fertilizer and pesticides is largely influenced by agents of agro-chemical suppliers with many farmers assuming spraying of chemicals as the only solution to pest problems. Basic principles for soil conservation and pest control such as crop rotation and mixed cropping are not often applied.

LIVESTOCK PRODUCTION

Livestock production in SOKNOT is characterized by semi-intensive mixed farming and extensive (pastoral) production systems. Pastoralists are responsible for 75 per cent of cattle herds in Kenya and 90 per cent in Tanzania. Livestock systems rely on indigenous breeds that have low yield genetics for meat and milk but have developed exceptional adaptive traits for the East African rangelands such as the ability to digest roughage from wild plants, resistance to endo-parasites and the capacity to walk long distances for water. Policy and governance structures play an important role in shaping pastoral practices. Rising individual ownership of land in Kenya for example, has led to the fencing of previously open pasture areas and a worsening of human-wildlife conflict in food production areas.

POST-HARVEST

Post harvest challenges are immense. Traditional storage methods such as cribs and gunny sacks predominate with an estimated 80 per cent of maize being stored in traditional storage structures in Tanzania. Despite government efforts to introduce warehouse storage facilities, adoption has often been poor due to various reasons. These include the cost of technology, loss of security that comes with keeping maize at home and a lack of understanding and trust of government schemes. Recent international interest in the cost of food waste has prompted interventions targeted at reducing losses during storage and, to a lesser extent, on other loss prevention technologies including mechanical shelling and solar driers for grains.

Post-slaughter meat handling and preservation in the

pastoral regions is carried out using traditional processing practices for preservation including salting, smoking, sun-drying and deep-frying, with meat products normally kept for two to three months. However, losses are estimated to be as high as 50 per cent, due to unsanitary post-slaughter handling and processing, lack of clean water and absence of refrigeration or preservation technologies and food hygiene practices. The implications for food safety are serious with increased risks of selling contaminated meat and endangering consumer health.

PROCESSING OF MAIZE

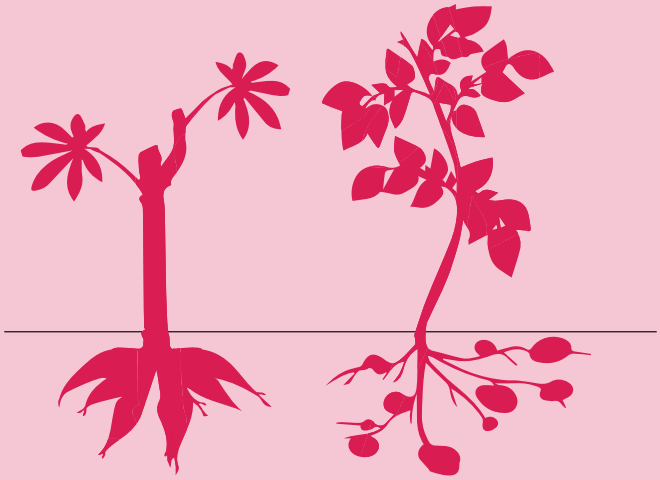
Processing of maize to produce un-sifted flour accounts for 60 per cent and 90 per cent of processed maize in Kenya and Tanzania respectively. However, the feed market for maize operates in direct competition with food products since maize and other grains account for 26 per cent of feed processed. The growing demand for animal feed has provided a new market for flour millers. Sorghum processing is currently carried out by small-scale processors producing either pure or blended flour. The secondary market for sorghum for beer production has provided a strong cash incentive for smallholders to grow it as a dual-purpose crop contributing to food security and income.

MARKET SYSTEMS

Market systems within the landscape are largely informal with small pockets of structured markets in areas where export horticulture is practiced. In Tanzania, high transportation costs, unreliable storage and limited market information are key factors preventing the efficient flow of staple foods from surplus producing areas to deficit areas. Due to ineffective storage methods, farmers usually sell their produce immediately after harvest when prices are at their lowest. In Kenya, smallholders sell less than 25 per cent of their production, retaining most of it for household consumption. Due to poor development of local slaughterhouses in Tanzania, an estimated 300,000 live cattle are sold across the border to Kenya every year. Food transport is hampered by the poor condition of rural roads that can be impassable for three to six months of the year due to erosion caused by the rainy season [19].

FOOD CONSUMPTION

Food consumption is dominated by four crops: maize, rice, wheat and sorghum. These crops provide about half the food-energy needs of households in the landscape. Prevalence of undernourishment in Kenya has increased from 20.8 per cent in 2012 to 24.2 per cent in 2017 while Tanzania has seen a marginal decline from 32.6 per cent to 32 per cent. At the same time, incidence of obesity in adults (especially women) has nearly doubled from 2008 to 2016 in both countries, reflected in the demand for food products, especially in urban centres. Additionally, meat consumption in the eastern Africa region is expected to increase from the 1997 baseline of 0.9 million tons to 2.2 million tons by 2025.



6M
METRIC TONNES CASSAVA PRODUCED IN 2017

5M
METRIC TONNES SWEET POTATO PRODUCED IN 2017

APPENDIX

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This paper summarizes and builds on research presented in an internal landscape report developed by Wasafiri for WWF in August 2019. Data was gathered through a multi-stage process of desk research, stakeholder interviews, field visits and analysis.

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