3. What Africa eats – the basic foods

Olawale Ogunkola and Vinaye Dey Ancharaz

This chapter examines food production and consumption in Africa in relation to the eight basic foods that we identify as essential for food security on the continent. Two are tubers (cassava and yams), three are cereals (maize, rice and wheat) and three are animal proteins (meat, poultry and fish). Following a comparative overview that situates Africa in relation to world food production, the core sections of the chapter examine temporal and spatial patterns in the production and consumption of the selected basic foods, drawing upon data (FAOSTAT) from the Food and Agriculture Organization of the United Nations (FAO). The chapter concludes with a discussion of ways in which climate change interacts with the basic foods and emerging adaptation and mitigation measures building upon the model of trade, food security and climate change identified in Chapter 2.

3.1 Africa in world food production and consumption

Africa, with 17 per cent of the world population, contributes about 8 per cent of global food production. In the 30 years between 1991 and 2021, the value of global food production increased at an average annual growth rate of 2.4 per cent, from $1.02 to $4.2 trillion. However, the world annual population growth rate was 0.80 per cent in 2022. Over the same period, Africa's food production grew at 2.1 per cent, below the continent's population growth rate of 2.4 per cent. This is not because Africa specialises in industries other than agriculture, since more of its economy is centred around agriculture than in the rest of the world (in 2022, agriculture, forestry and fishing accounted for 15 per cent of the continent's gross domestic product (GDP), compared to only 4 per cent for the world as a whole). It is because productivity in

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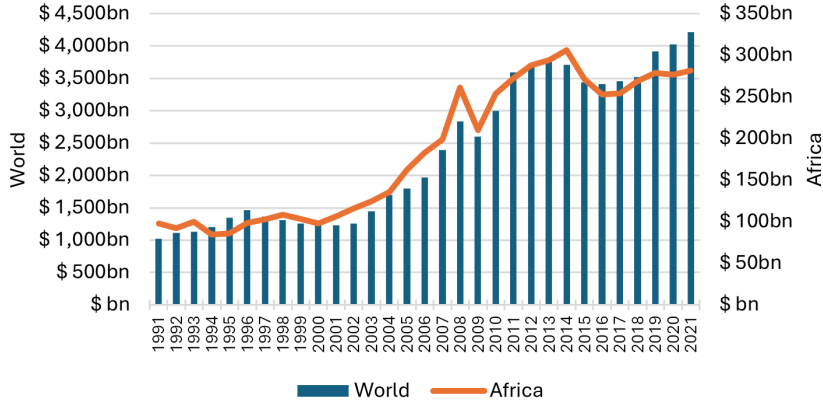
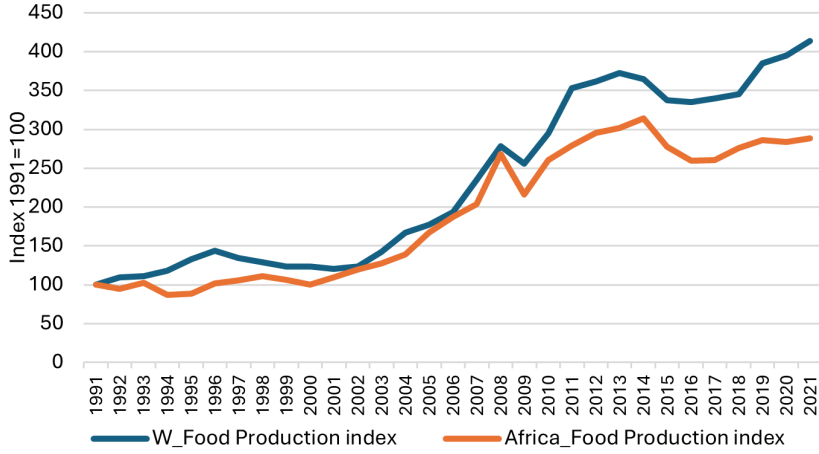
Figure 3.1: Food production value (US$ billion, current prices), Africa and the world, 1991–2021



Source: Authors based on data from FAOSTAT.

Figure 3.2: Gross Food Production Value Index, Africa and the world, 1991–2021 (1991 = 100)

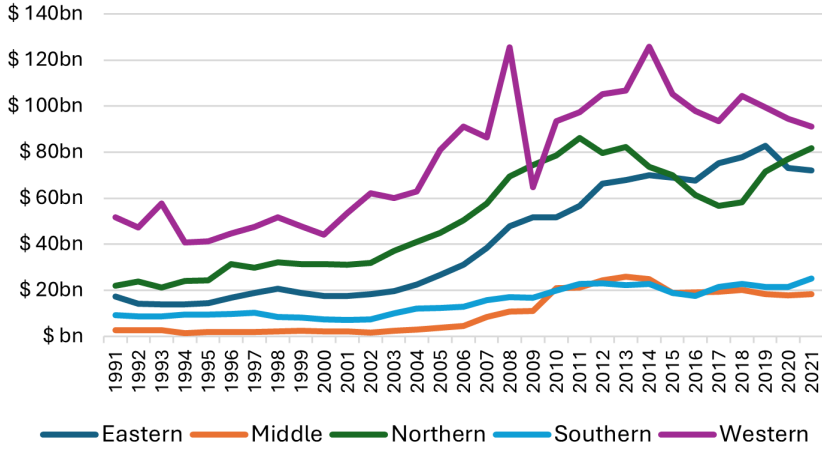


Source: Authors based on data from FAOSTAT.

agriculture (and the economy as a whole) is much lower than in the rest of the world (authors' analysis of World Bank Open Data n.d.).[1]

Figures 3.1 and 3.2 present these trends in global and Africa food production in value and index, respectively. Figure 3.1 shows world food production (left hand axis) quadrupling from $1 trillion in 1991 to $4.2 trillion in 2021 in current prices. The value of Africa's food production

Figure 3.3: Food production (US$ billion, current prices) by African subregion, 1991–2021



Source: Authors based on data from FAOSTAT.

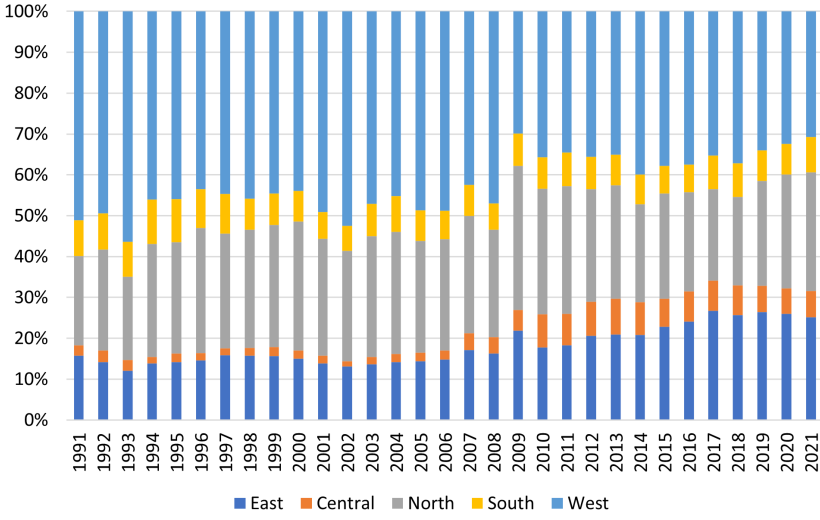
(right axis of Figure 3.1) also increased from US$92.3 billion in 1991 to US$281.2 billion in 2021 in current prices, but below the global trend in the three decades.

Figure 3.2 presents global and Africa food production indexes, with the 1991 level set at 100. The indexes trended together until 2008, when the world food production index was 278.13 and the corresponding figure for Africa was 268.19. However, since 2008, a gap has emerged between the two and this was maintained even during the 2020–2021 Covid-19 shock. Although drawn from different data sets, these trends against the demographic background are consistent with headline data on food security that were introduced in Chapter 1.

Africa is of course far from being homogeneous. While regional variations may hide country differences, some broad contours are discernible from regional food production patterns. Figure 3.3 shows the trends in the value of Africa's food production by region. The shares of the different regions in food production by value are shown in Figure 3.4. All regions recorded an overall increase in the value of food production over the period, with population, policy, productivity, conflict, climate and ecological factors accounting for some of the fluctuations.

West Africa, the continent's most populous region, accounting for about 40 per cent of production, illustrates very well the variations in production consistency due to the factors that have been mentioned. Similar fluctuations are also evident in Northern, Eastern, Southern and Central Africa's production.

Figure 3.4: Regional shares (in percentages) in Africa food production value, 1991–2021



Source: Authors based on data from FAOSTAT.

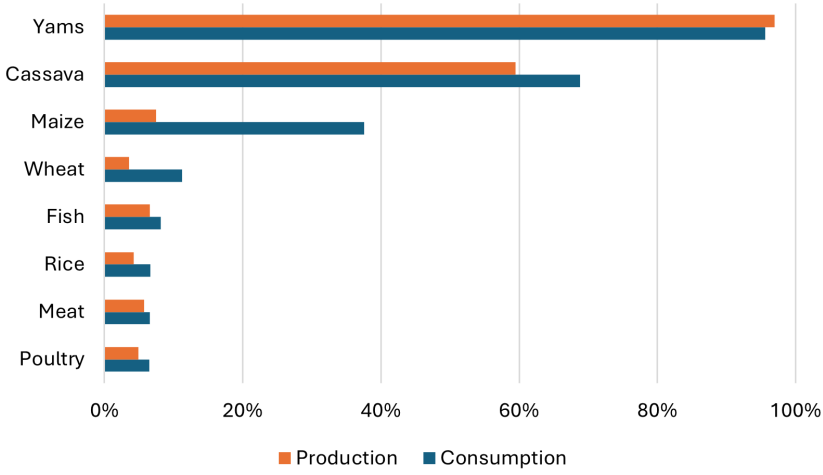
3.2 The selected basic foods in relation to global production and consumption

A very revealing picture emerges from Figure 3.5. This shows Africa's global average percentage share of production and consumption of basic foods between 2010 and 2020. Keeping in mind that Africa's share of the world population was around 17 per cent during this period, this gives a broad sense of per capita distribution. Consumption outstripped production of every product except yams. This is consistent with the headline data on food security in terms of availability and stability that was noted in Chapter 1 and the food trade deficit discussed in Chapter 2.

Before looking more closely at the data on the production and consumption of these basic foods, we should note that several of these products have competing uses. An issue of interest is estimation of the food balance sheet[2] of each of the products in the basket of basic foods. Figure 3.6 shows the distribution of the main uses: (human) consumption versus feed for livestock and 'other uses'.[3] With less than half (45 per cent) of production going into consumption, yams are the produce with the lowest use for food. But this also suggests that, with yam food sufficiency attained, other uses provide an important utilisation channel.

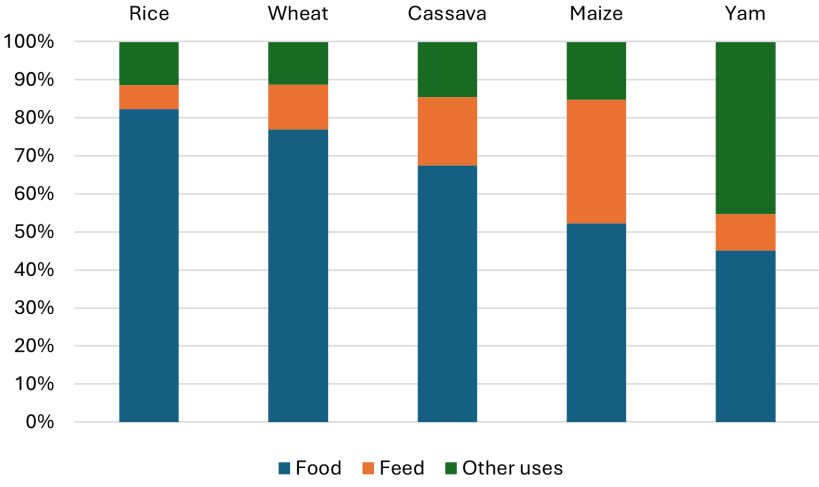
The proportion of these products that went into livestock feed varied from 6.2 per cent of rice to about a third of maize and a fifth of cassava. In relation to 'other uses', seed accounted for 24 per cent of yam utilisation. A significant

Figure 3.5: Africa's share (in percentage) of in global food production and consumption by weight, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.6: How rice, wheat, cassava, maize and yams were used in Africa in 2020, percentage shares

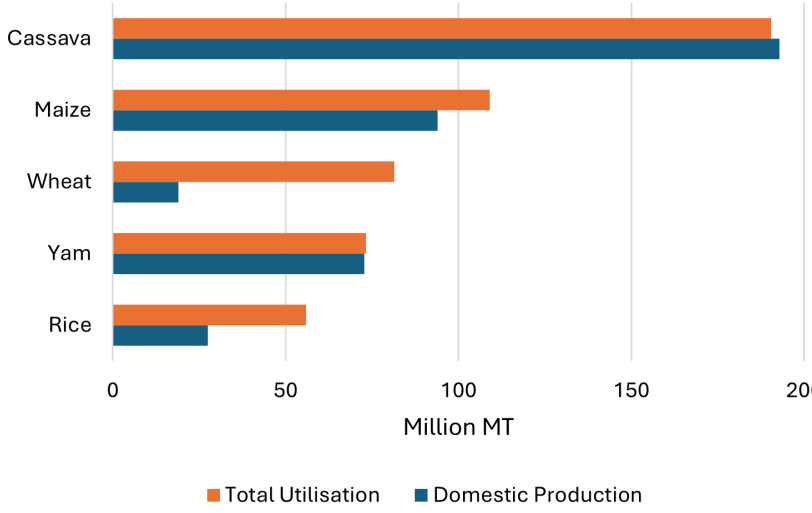


Source: Authors based on data from FAOSTAT.

proportion of cassava production, about 11 per cent, was wasted in production and processing.

Finally, Figure 3.7 presents a comparative perspective on domestic production and utilisation of the products. Apart from cassava and yams, where production and utilisation trended closely, continental utilisation of wheat, rice

Figure 3.7: Domestic production versus total utilisation, million MT, 2020



Source: Authors based on data from FAOSTAT.

and maize outstripped domestic production. Only 23 per cent, 49 per cent and 86 per cent of continental utilisation of wheat, rice and maize, respectively, were supplied through domestic production in 2020. Here again, although different data sets are being tapped, the trend is consistent with the food trade deficit that was noted in Chapter 2.

3.3 Trends in the production and consumption of basic foods in Africa

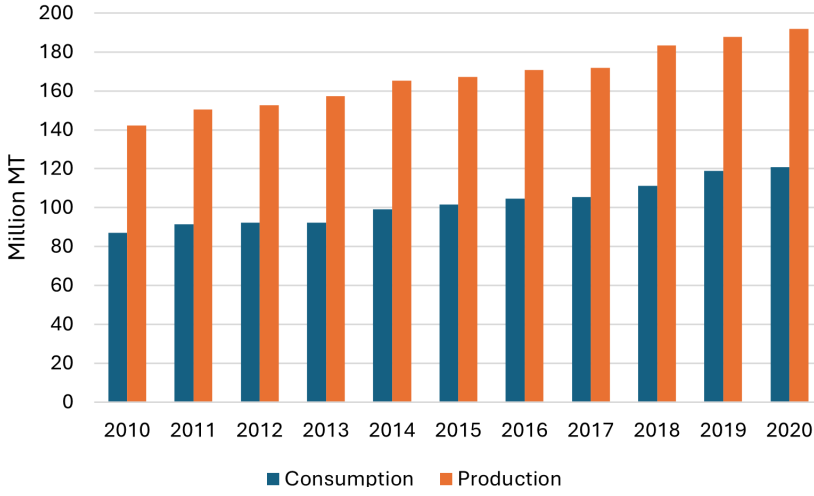
We now turn to look more closely at production and consumption of each of the eight basic foods.

Cassava

Cassava, a perennial shrub, is grown mainly by small-scale farmers for its tubers. The leaves are also edible as vegetables. Essentially a subsistence food crop, it is rich in carbohydrates, calcium, vitamins B and C and other essential minerals. It is a staple food in Central and East Africa, especially Democratic Republic of the Congo (DRC), Congo and Tanzania, and parts of West Africa.

The entire cassava plant is versatile and a boon for sustainable agriculture. Its stems, branches, leaves and tubers can be used as animal feed. This means

Figure 3.8: Cassava: Africa's production and consumption, million MT, 2010–2020



Source: Authors based on data from FAOSTAT.

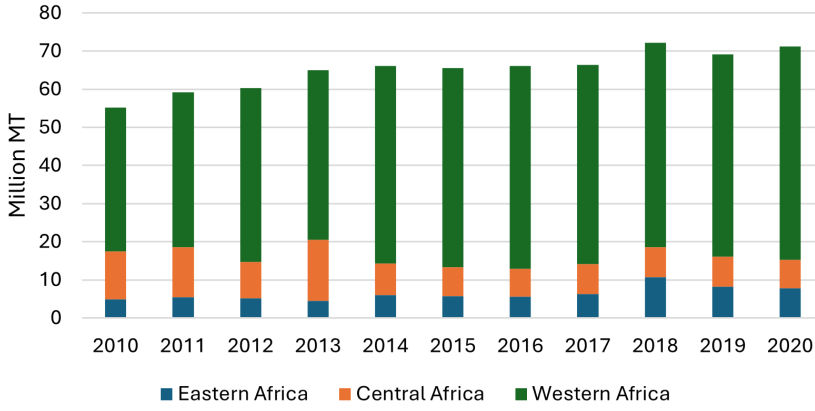
that only a fraction of the land needed for cultivation of cereals and oil seed crops for animal feed is used in cassava production (Balagopalan 2001).

Industrial derivatives of cassava include starch that can be used as industrial inputs for food, medicine, cosmetics, textiles, paper, confectionery, beverages, feed, biodegradable materials, adhesives and glues, chemicals, fuel ethanol (Goodway n.d.) and so on. Cassava flour, which unlike wheat flour is gluten-free, is seen as a healthy alternative for making bread and other pastries. Cassava flour can be used as a substitute for wheat flour or mixed with wheat flour to reduce the gluten content of the final product. Nigeria's cassava flour policy (based on a 2002 presidential initiative) requires bread to contain at least 10 per cent cassava flour as a measure to reduce wheat imports and generate other economic benefits including employment along cassava value chains. A survey in Eastern Nigeria revealed that up to 97 per cent of bakeries in 2017 were using cassava flour in baking (Onyekuru et al. 2019).

Africa dominates cassava production and consumption. According to FAOSTAT, the top seven cassava growers in the world are Nigeria (60 million metric tonnes (MT)), DRC (41 million MT), Thailand (29 million MT), Ghana (22 million MT), Brazil (18.2 million MT) and Viet Nam (10.5 million MT). West, Central and Eastern Africa are the main producers, with West Africa producing about half of Africa's production. As would be expected, these regions also account for most of Africa's consumption. Figure 3.8 shows a consistent rising trend in cassava production that outstrips consumption.

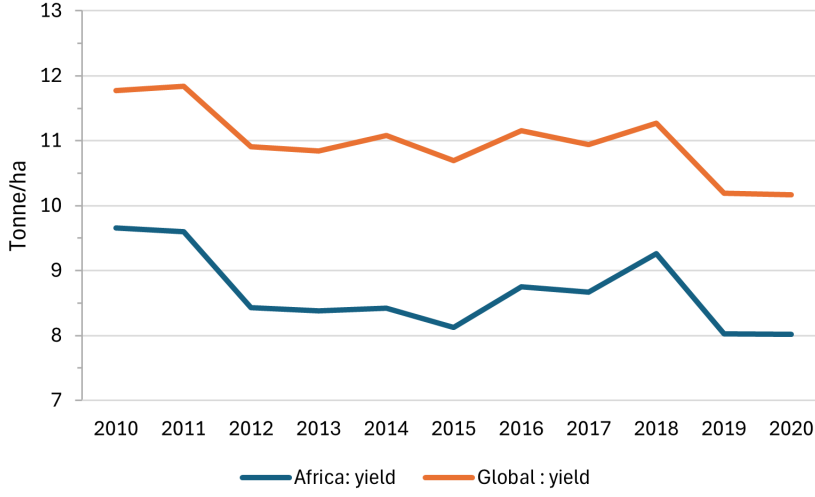
As shown in Figure 3.9, all the African producing regions are net cassava producers.

Figure 3.9: Cassava production net consumption in selected subregions of Africa, million MT, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.10: Estimated cassava yields in Africa and the world, tonne/ha, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.10 provides insight into productivity challenges even for an endemic product like cassava. As can be seen, Africa's cassava yield is comparable with the global average, as the two trended together. But Africa's yield is consistently below the global average yield, suggesting room for productivity improvement. Efforts to increase cassava productivity would require inputs and practices such as improved cassava stem cuttings, adequate spacing of

cassava stems during planting, improved soil preparation, application of fertilisers and irrigation. Though the crop is resilient, yields are being adversely affected by low or irregular rainfall, warmer temperatures and drier conditions that are among the features of climate change. Research suggests that cassava yield can increase sixfold when water supplied irrigation is relatively equal to that of the season's rainfall (Goodway n.d.).

With evidence to suggest that embracing modern farming methods would increase yields and adapt cassava production to climate risks, the Ibadan-based International Institute for Tropical Agriculture (IITA) is at the forefront in developing adaptation measures such as high-yielding vitamin A-fortified cassava varieties. The institute's intervention programmes include development of disease- and pest-resistant cassava varieties that are drought-resistant, early-maturing and high-yielding, with lower cyanide content.

Yams

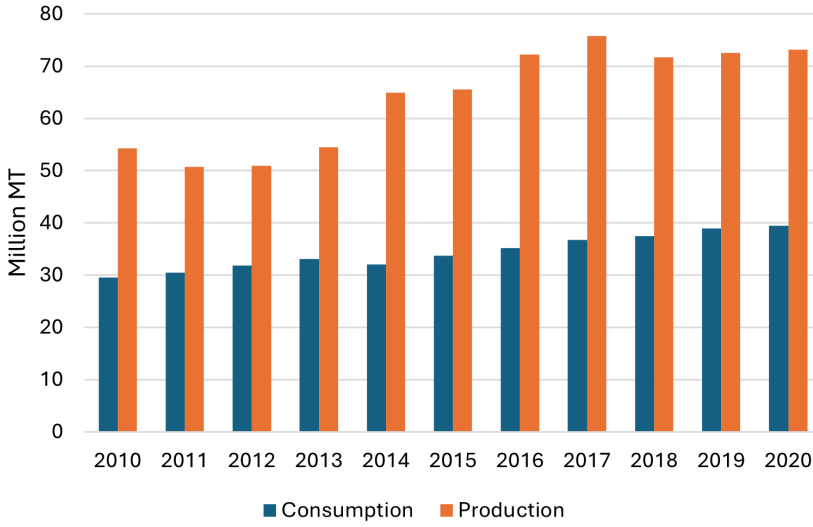
As with cassava, the continent is important globally in yam production and consumption. And, like cassava, yams are both a subsistence crop and source of income for smallholder farmers. The tuber is rich in carbohydrates, vitamin C and some essential minerals. Nigeria and other West African countries are where this staple food is mainly grown and consumed. The crop is increasingly processed to produce yam flour, which is consumed as semolina. Unlike cassava it is not widely used as animal feed but it has industrial application as an all-purpose adhesive used in packaging and in the production of leather goods such as shoes.

The continent's yam production is strong, with a generally increasing trend to 73.2 million MT in 2020, as shown in Figure 3.11. In 2020, African countries accounted for 98 per cent of the world's 74.8 million MT yam production. Nigeria alone reported two-thirds of African production.

In terms of productivity, Africa's and global estimated yam yields are virtually the same. However, this is unsurprising given that the continent accounts for 98 per cent of global production – Africa's yam production *is* the world's yam production. Comparing African yields with those from the 2 per cent of production that occurs in other regions, estimated African yields are 82 per cent of those in Latin America and 57 per cent of those in Oceania, as of 2022.[4]

The IITA, which carries out research on selected tropical agricultural products including yams, cassava and maize, has suggested that with appropriate inputs, adaptation strategies and modern farming methods farmers should be able to achieve 20 ton/ha (Bouchene et al. 2021). This is over twice Africa's (and the world's) current average yield. Achieving higher levels of productivity is an increasingly important priority as expanding acreage under cultivation through deforestation and biodiversity loss is not sustainable.

Figure 3.11: Yam production and consumption in Africa, million MT, 2010–2020



Source: Authors based on data from FAOSTAT.

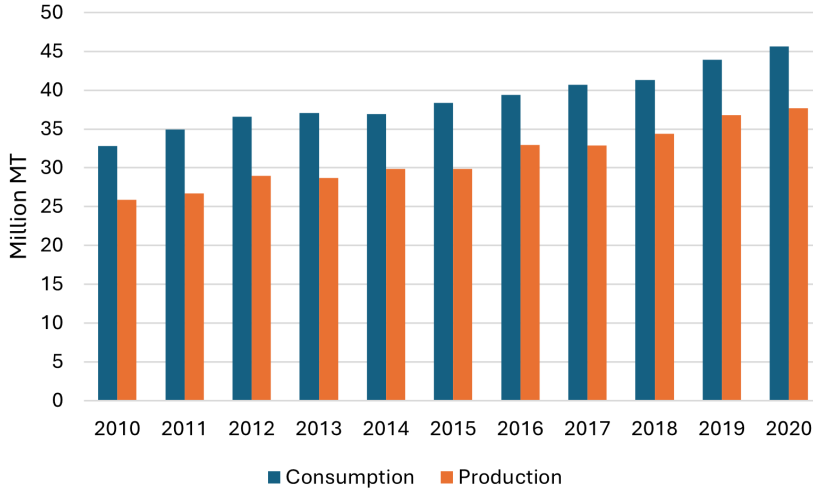
Rice

Rice is an important commodity for food security and a source of dietary energy throughout the continent but especially in West Africa. It is the fourth most important source of calories in Africa, behind maize, wheat and cassava. It is a source of livelihood for more than 35 million smallholder rice farmers. A crop that can thrive in diverse ecosystems, it is cultivated in 40 out of 54 countries in Africa (Seck et al. 2012). Cultivation in Africa occurs in four ecosystems: dryland (38 per cent of the cultivated rice area), rainfed wetland (33 per cent), deep-water and mangrove swamps (9 per cent) and irrigated wetland (20 per cent) (Balasubramanian et al. 2007). However, irrigated rice production is known to be a contributor to greenhouse gas (GHG) emissions, which is a source of concern as it is estimated that land use and forestry emissions accounted for about 40 per cent of Africa's total emissions, with half of this coming specifically from agricultural activities (*AfricaRice* 2020).

In contrast to cassava and yam production, Africa's production of rice is relatively small, accounting for only 5 per cent of global production in 2020. The main African producers are in West Africa (Nigeria, Mali, Guinea, Côte d'Ivoire, Senegal and Sierra Leone), East Africa (Tanzania and Madagascar), North Africa (Egypt) and Central Africa (DRC). Each produced more than 1 million MT in 2020.

Rice consumption in Africa outstrips production, as shown in Figure 3.12. Demand for rice is estimated to be growing at more than 6 per cent a year,

Figure 3.12: Rice production and consumption in Africa, million MT, 2010–2020



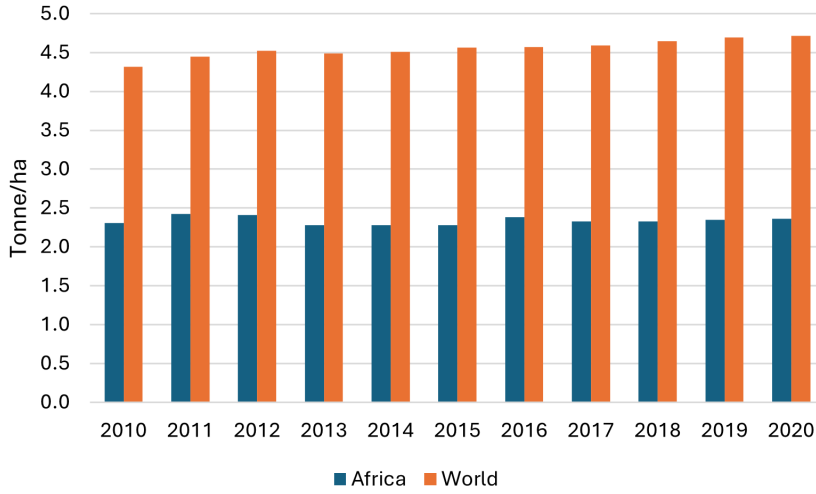
Source: Authors based on data from FAOSTAT.

making it the fastest-growing food staple in Africa. Population growth and urbanisation are the main factors driving this growth.[5] The latter has a double impact in terms of its pull factor, which drains farm communities of labour and produces a strong consumer preference for rice in urban areas. Rice is one of the products that drives Africa's status as a net food importer (see Chapter 2).

Rice yield in Africa is about half of the global average (4.69 tonnes/ha, compared to 2.40 tonnes/ha in Africa, in 2020) (Figure 3.13). But productivity is higher in Egypt, which generates a yield that is more than three times the world average, at 9.4 tonne/ha versus 3 tonne/ha. Natural endowments such as favourable climatic condition including high sunlight intensity, limited presence of pests, insects and disease, and the fertile plains of the Nile delta contribute to higher productivity in Egypt. But the success of Egyptian rice is also due to investment in well-designed irrigation systems, new short-duration, high-yielding varieties, and the use of modern production technologies in rice farming. Egypt's national Rice Campaign programme takes an adaptive approach to the monitoring of production constraints and challenges, which are promptly addressed by the various agencies that are part of the programme.

In other parts of Africa, variable rainfall in upland ecologies, drought, flood, extreme temperatures, soil quality and erosion, pests and underinvestment are among the factors accounting for low productivity. Efforts are being made to develop rice varieties such as New Rice for Africa (NERICA), with early maturity, improved yield and tolerance to major stresses, by Africa Rice Center (*AfricaRice*).

Figure 3.13: Estimated rice yields in Africa and the world, tonne/ha, 2010–2020



Source: Authors based on data from FAOSTAT.

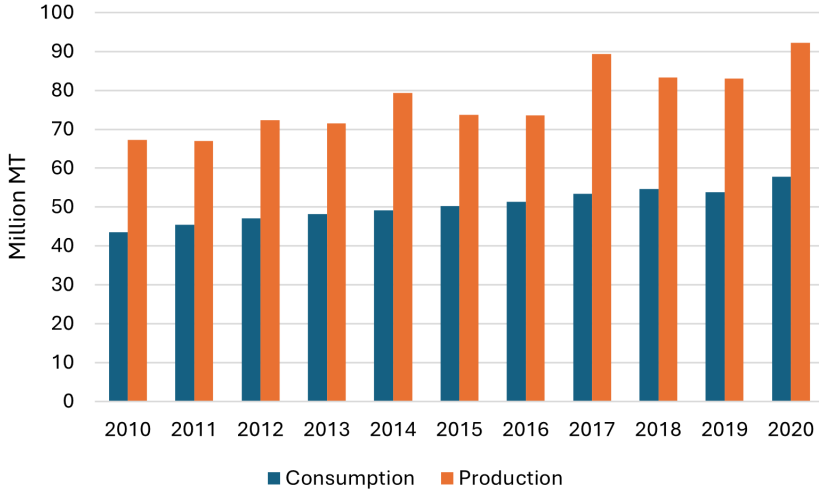
Maize

Maize is an important staple food for some 300 million Africans, especially those in Central, Eastern and Southern Africa. It is a low-cost source of starch, fibre, protein, vitamins and minerals, such as magnesium, zinc, phosphorus and copper (Bathla, Jaidka and Kaur 2020). It accounts for 30–50 per cent of low-income household expenditure in Africa. Besides human consumption, maize is a major input into the manufacturing of animal feed, especially for poultry. On average, maize used in animal feeds is about a third (33.3 per cent) of the total utilisation in Africa, as depicted in Figure 3.6. Maize is also used in the manufacturing sector. For instance, about 20 per cent of maize produced in Nigeria is used in brewing beers, industrial flour, corn flakes and other confectioneries (PWC 2021, p.20).

Like rice, Africa's maize production is a relatively small share of global production. Maize is widely grown on the continent but West and Eastern Africa account for two-thirds of production. The top five African producers of maize are Nigeria, Tanzania, Ethiopia, Egypt and South Africa.[6]

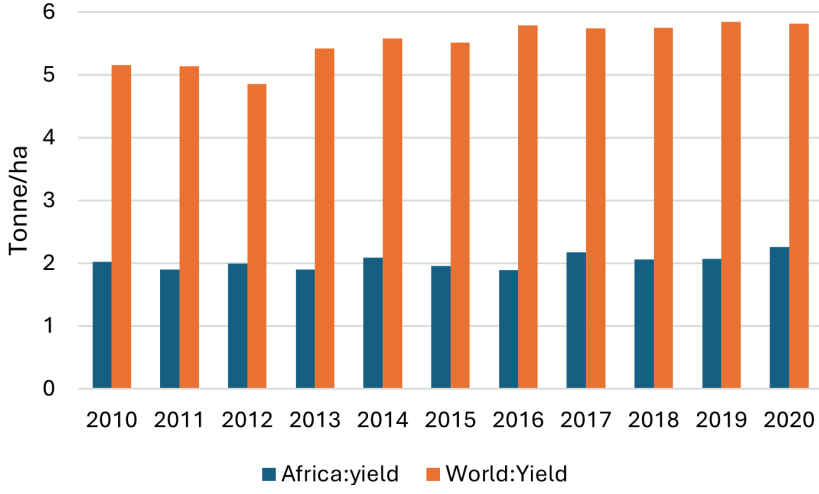
Africa produces more maize than it consumes, as shown in Figure 3.14. However, the continent is a net importer of maize as the excess production over human consumption is not sufficient to meet demand for other uses of maize including feeds for livestock and industrial processing and manufacturing. For instance, in 2020, total utilisation of maize was estimated at 109.04 million MT, compared to 93.89 million MT of domestic production (Figure 3.7), leaving a balance of about 15 million MT sourced from international markets.

Figure 3.14: Maize production and consumption in Africa, million MT, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.15: Estimated maize yields in Africa and the world, tonne/ha, 2010–2020



Source: Authors based on data from FAOSTAT.

However, maize yield in Africa, though increasing over the years, is less than half the world average yield (Figure 3.15). Regional differences in maize yield on the continent are wide. North Africa performed above the global average in the last four decades. In 2021, North Africa's maize productivity of 6.6 tons/ha was about 111 per cent of the global average.

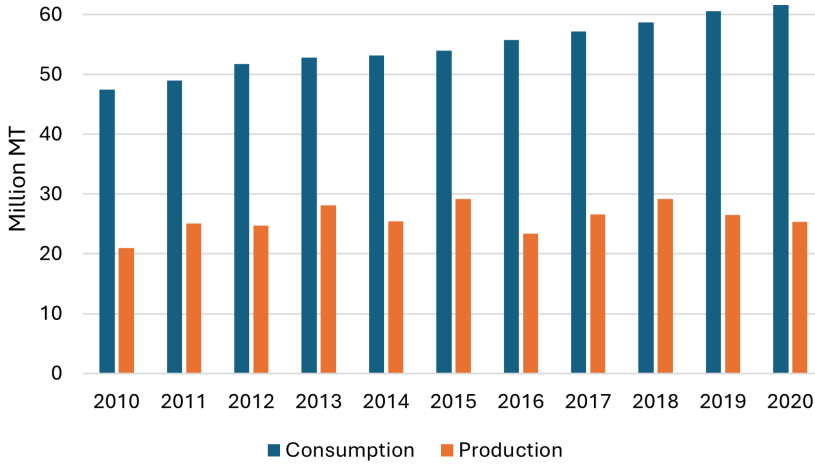
There have in recent years been productivity improvements in Southern Africa, where there was an average yield of 5.0 tonne/ha in 2020. Variable weather conditions are among the factors that account for lower yields elsewhere in Africa as rainfed agricultural practices dominate.

Wheat

Wheat is an important source of carbohydrates, protein, fat, minerals (zinc and iron, selenium and magnesium) and vitamins (thiamine and vitamin B). Unlike maize and rice, wheat grows best in a temperate region between 14 and 18 degrees Celsius. Wheat production in much warmer areas is feasible but requires technological support. At around 3 per cent in 2020, the continent's share of global production is small. In 2020, 65 per cent of Africa's wheat was produced in North Africa, with East and Southern Africa accounting for 25 per cent and 9 per cent, respectively, in 2020. The top six producers of wheat in Africa are Egypt, Ethiopia, Algeria, Morocco, South Africa and Tunisia.[7]

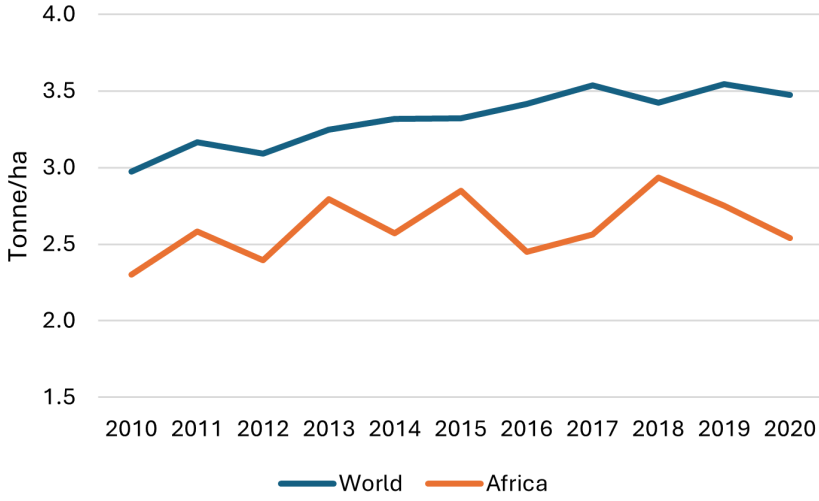
Africa consumes more wheat than it produces, as shown in Figure 3.16. Africa's average share of global consumption was 11.2 per cent for the period between 2010 and 2020. In 2020, North Africa accounted for almost 60 per cent of Africa's wheat consumption; East and West Africa each accounted for around 15 per cent, with Southern and Central Africa making up the rest. This is why North Africa and some parts of East and West Africa were at risk from the fallout from Russia's invasion of Ukraine.

Figure 3.16: Africa's wheat production and consumption, million MT, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.17: Estimated wheat yields in Africa and the world, tonne/ha, 2010–2020



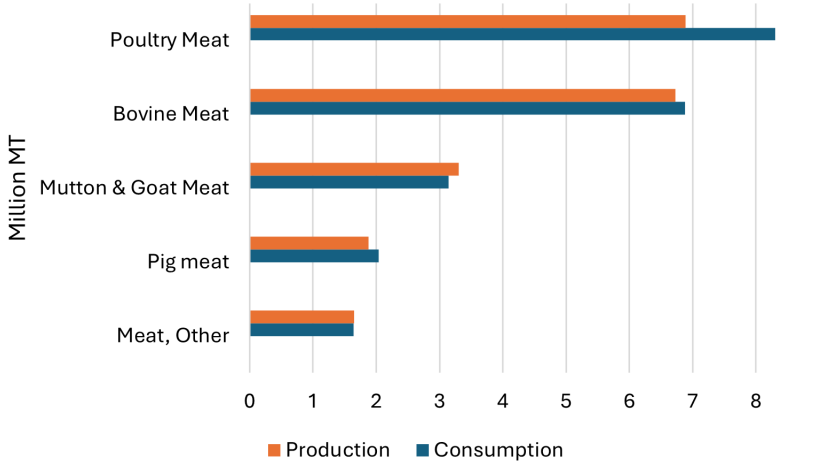
Source: Authors based on data from FAOSTAT.

Wheat productivity in Africa trends below the rest of the world, as shown in Figure 3.17. Closing the yield gap will be a challenge given that global wheat yields fell by 5.5 per cent during 1980–2010 owing to rising temperatures. Pequeno et al. (2021) simulated climate change impacts and adaptation strategies for wheat globally using new crop genetic traits. The model projected that climate change would lower global wheat production by a further 1.9 per cent by 2050. The simulation suggested that most of the negative impacts are likely to affect developing countries in the tropical regions. Africa and South Asia are expected to bear the brunt of this impact as wheat yields are projected to decline by 15 and 16 per cent, respectively, by 2050.

Meat

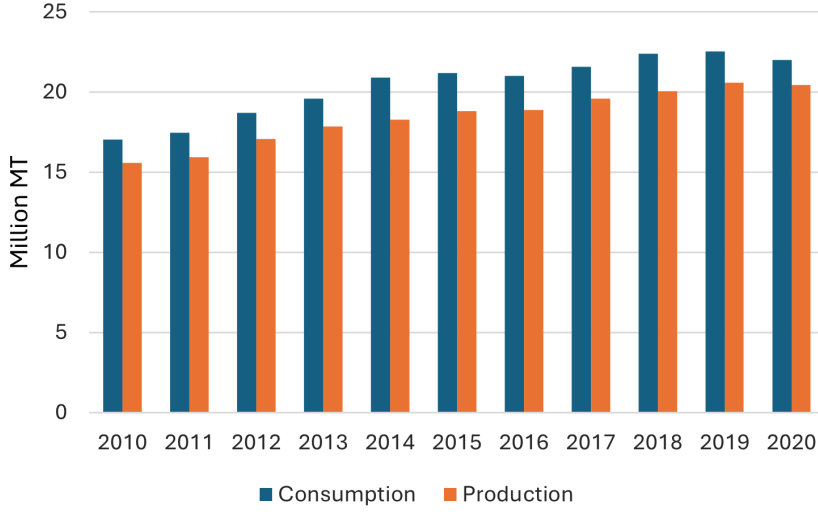
Meat is a source of protein, iron, vitamin B12 (as well as other B complex vitamins), zinc, selenium and phosphorus. It is obtained from different livestock types. Africa's livestock accounts for one-third of the global livestock population and about 40 per cent of agricultural GDP in Africa, ranging from 10 per cent to 80 per cent in individual countries (African Union – International Bureau for Animal Resources (AU-IBAR) 2016; Balehegn et al. 2021; Malabo Montpellier Panel 2020). However, the challenge is Africa's low output of livestock outputs as captured in the low yield. Poultry is the largest source of meat, closely followed by bovine meat. Mutton and goat meat are also important. Production of pig and other meat is smaller. (Figure 3.18). Meat of all types is the focus of this section. The next section focuses on poultry specifically.

Figure 3.18: Africa's meat by livestock, million MT, 2020



Source: Authors based on data from FAOSTAT.

Figure 3.19: Africa's production and consumption of meat, million MT, 2010–2020

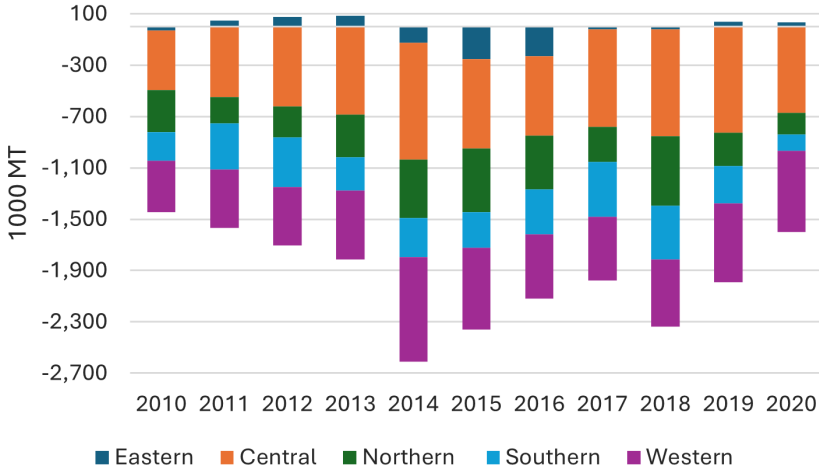


Source: Authors based on data from FAOSTAT.

Africa's total meat production was 20.5 million MT in 2020 (Figure 3.19), or about 6 per cent of the 337.8 million MT global production of meat. North and East Africa each accounted for about 27 per cent of Africa's production in 2020. West, Southern and Central Africa accounted for 20, 17 and 9 per cent, respectively.

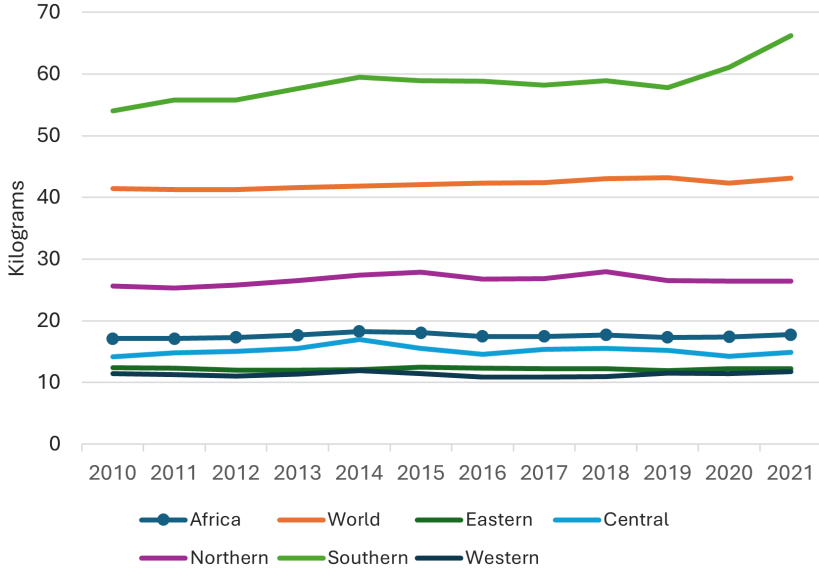
Africa consumes more meat than it produces (Figure 3.20). This also contributes to the continent's status as a net food importer, as discussed in

Figure 3.20: Africa's net consumption of meat, thousand MT, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.21: Meat food supply quantity (kg/capita/yr) by African subregion, 2010–2021



Source: Authors based on data from FAOSTAT.

Chapter 2. Africa's annual average meat consumption is consistently below 20 kg per capita and hovers around 17 to 18 kg, as shown in Figure 3.21. It is less than 50 per cent of the world average of between 41 and 43 kg. But North Africa's average per capita meat consumption of between 25 and 28 kg is above the African average, while Southern Africa's consumption of

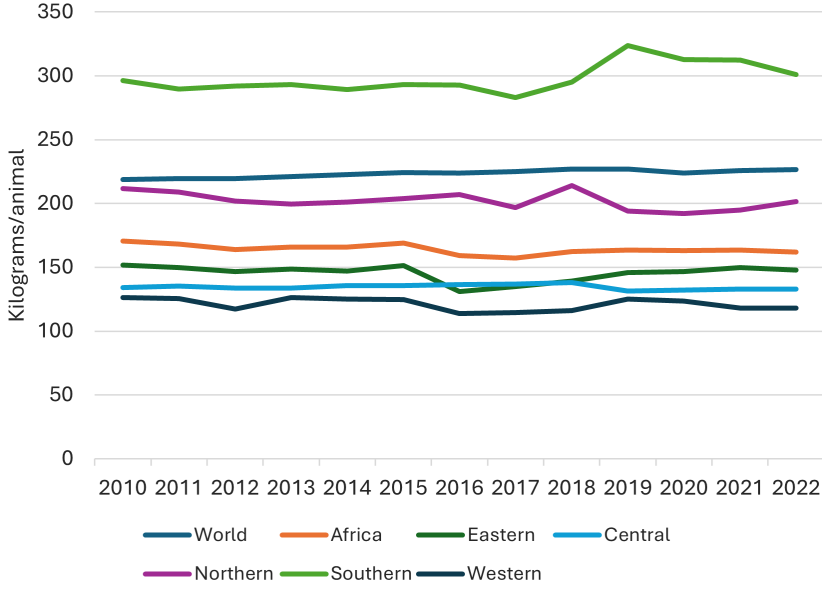
between 54 and 66 kg is not only above Africa's average but higher than the world's average.

South Africa is the most productive cattle and pig producer in Africa, with yields of 231 kg and 86 kg per animal, respectively. The country also ranked high as one of the most productive poultry producers in Africa, with a yield of 1.94 kg per bird. This performance is attributed to policy interventions especially for the maintenance of good animal health, reduction of incidence of diseases outbreaks and support for commercialisation of communal farms (Balehegn et al. 2021).

The main factors constraining meat production include (1) the quandary between husbanding lower-yielding traditional but more resilient breeds and productive exotic breeds; (2) informal markets underpinned by sociocultural systems; (3) a variety of endemic animal diseases; (4) underinvestment in facilities that support downstream and upstream production activities; (5) perennial difficulties in accessing animal feed; and (6) climate change, which is reducing the grazing land available (Rich et al. 2022).

Climate change is also driving conflicts over land between nomadic pastoralists and crop farmers. Rising temperatures and weather variabilities reduce the availability of feeds, forages and grazing areas, all of which contributes to lower yields (Figure 3.22). Efforts aimed at meeting projected increase in demand for meat must simultaneously address climate change risk.

Figure 3.22: Yield: beef and buffalo meat, primary, kg/animal



Source: Authors based on data from FAOSTAT.

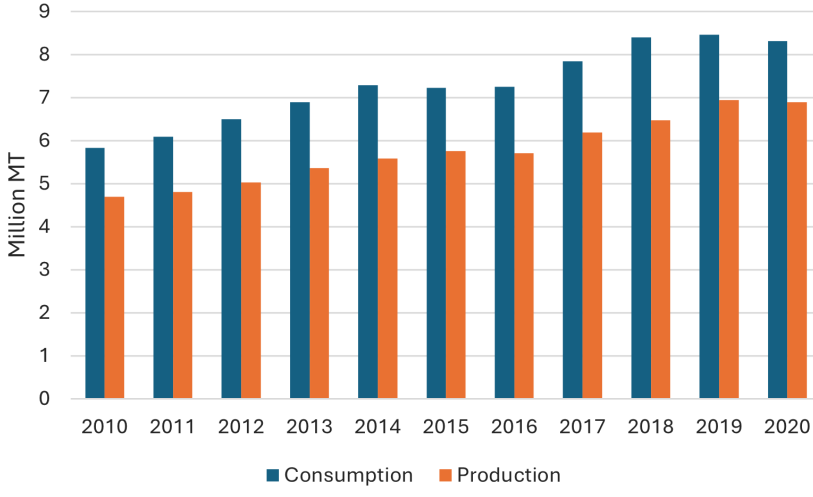
African livestock has significant impacts on the environment. It is estimated that more than 70 per cent of agricultural GHG emissions in Africa come from livestock dominated by enteric methane (CH_4) emission. Methane can reduce crop yields by contributing to the formation of ground-level ozone and rising temperatures (Shindell et al. 2019). It is also estimated that the emission per unit of livestock product in Eastern Africa is four times the global average (Rich et al. 2022).

Poultry

Poultry meat, like other meat, is a good source of protein. It is rich in vitamins C and B6, iron, calcium, magnesium and cobalamin. It is also a good source of essential fatty acids. Chicken eggs have been identified to represent the lowest-cost animal source for proteins, vitamin A, iron, vitamin B12, riboflavin and choline and the second-lowest-cost source for zinc and calcium (Réhault-Godbert, Guyot and Nys 2019).

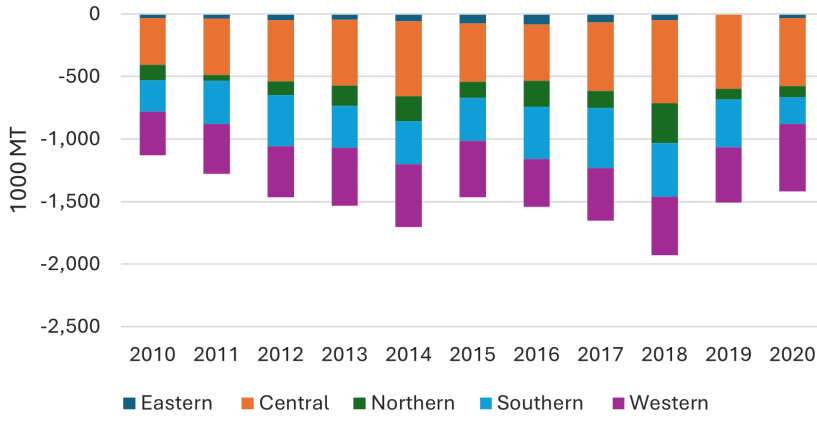
In 2020, Africa provided only 5 per cent of the world's poultry production. In terms of regional breakdown, Southern Africa accounted for 48 per cent – almost half of the continent's production – North Africa accounted for 25 per cent, West and East Africa each accounted for 12 per cent and Central Africa accounted for 2 per cent. As shown in Figures 3.23 and 3.24, Africa is a net consumer of poultry meat. But poultry meat per capita consumption, at 6 kg, is far below the global average, at

Figure 3.23: Poultry meat consumption and production in Africa, million MT, 2010–2020



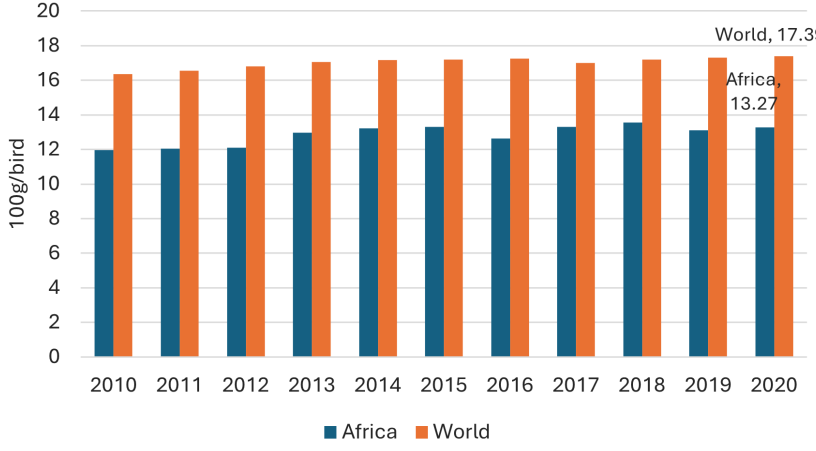
Source: Authors based on data from FAOSTAT.

Figure 3.24: Africa's poultry meat production net consumption by subregion, thousand MT, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.25: Poultry yields in Africa and the world, 100g/bird, 2010–2020



Source: Authors based on data from FAOSTAT.

15 kg. This is consistent with the headline data on undernourishment in Africa that was discussed in the Preface.

Africa's poultry yield trends below the global average (Figure 3.25). Rising temperatures and heat stress have been linked to 'poultry death losses, loss of quality and quantity of eggs and reduced growth in intensive production system' (Tabler, Wells and Moon 2021). Heat stress occasioned by climate change affects poultry production directly or indirectly in several ways. The direct effect includes a negative impact on chicken growth and productivity

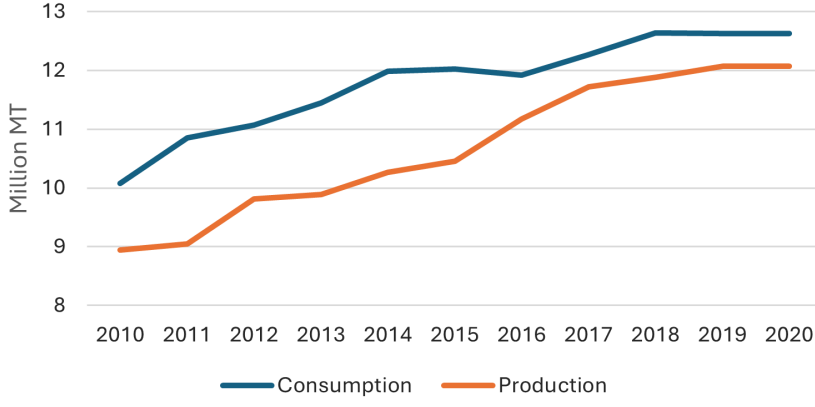
(Liverpool-Tasie, Sanou and Tambo 2019), a reduction in the productive efficiency of hens and hence egg production (Mashaly et al. 2004) and a decrease in poultry production at temperatures higher than 30°C (Ensminger, Oldfield and Heinemann 1990). The indirect effects work through inputs to poultry production such as quality and quantity of feed and water. It reduces feed intake, weight gain, carcass weight and protein content (Tankson et al. 2001).

Fish

Fish is a source of high-quality and low-cost proteins. It provides essential amino acids, omega-3 fatty acids, minerals, especially iron and zinc, and vitamins. The three main fish production systems – marine, freshwater and aquaculture – account for 58, 27 and 15 per cent, respectively, of Africa's production. Thirty per cent of the continent's population, approximately 200 million people, consume fish as the main animal protein source (African Natural Resources Centre (ANRC) 2022).[8] Africa's fisheries sector employs 12.3 million people, with 6.1 million (50 per cent) employed as fishers, 5.3 million (42 per cent) as processors and 0.9 million (8 per cent) as fish farmers. The sector is important as a source of not only nutrients but also livelihoods (Obiero et al. 2019).

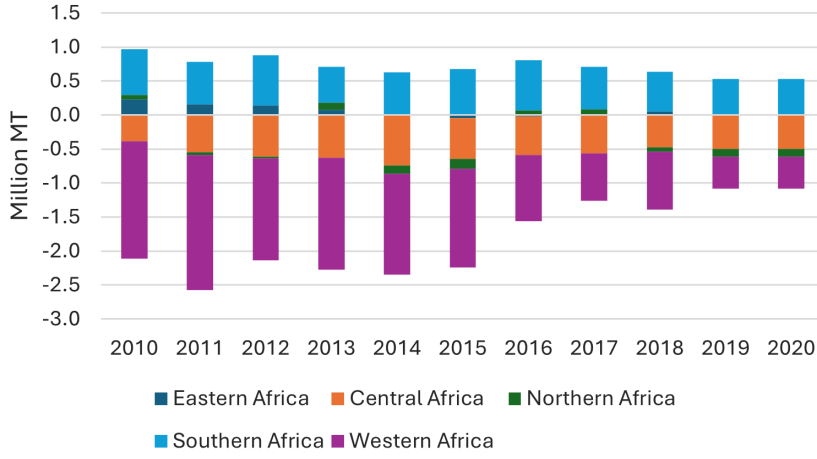
At 8 per cent in 2020, Africa's share of world fish production is relatively small. In the regional breakdown, North Africa contributed 32 per cent of the continent's production in 2020. This was closely followed by West Africa at 30 per cent, with East, Central and Southern Africa accounting for 19, 10 and 9 per cent, respectively. Figure 3.26 shows that Africa consumes more fish than it produces. Consumption in West and Central Africa is mainly responsible for

Figure 3.26: Africa's fish consumption and production, million MT, 2010–2020



Source: Authors based on data from FAOSTAT.

Figure 3.27: Africa's fish production net of consumption, million MT, 2010–2020



Source: Author based on data from FAOSTAT.

the deficit. Southern Africa consistently produced a significant surplus, while Eastern and North Africa produced marginal surpluses (Figure 3.27).

Challenges facing the fish sector in Africa include underinvestment in the management of fish stocks, the marine environment and freshwater habitats, illegal unregulated and unreported fishing by foreign fleets as discussed in relation to the World Trade Organization (WTO) Fisheries Agreement in Chapter 9, and rising sea temperatures. The latter has a disproportionate effect on small-scale fishing communities, which make up a large part of Africa's fisheries. As the sea temperature rises, fish stocks migrate towards colder waters. This increases pressure on small-scale fishing communities to scale up operations by investing in equipment and vessels that can go out further into the sea (African Natural Resources Centre (ANRC) 2022; Lovei 2017).

3.4 Climate risks

As noted in Chapter 2, the story of Africa's food security, agricultural trade and climate impacts is complex and cannot be reduced to a simple narrative. But it is also clear that climate change has varying effects on production and consumption of basic foods. We conclude this chapter by outlining some of these effects.

It is well known that surface temperature in Africa is rising faster than the global average. Between 1991 and 2021, Africa warmed at an average 0.3°C – that is, 0.1°C faster than in the preceding three decades (IPCC 2022; World Meteorological Organization 2023). This trend is set to continue in all IPCC scenarios, depending on the effectiveness of mitigation and adaptation measures across the world.

The consequences are clear. The sea level along African coastlines is rising more rapidly than the global mean rate, leading to coastal flooding and increased salinity of groundwater. Water stress is mounting as freshwater sources dry up. Extreme weather events have become more frequent, more severe and more diverse across the continent, with drought in East Africa, floods across much of the continent, storms in South East Africa and wildfires in North Africa (Emergency Events Database (EM-DAT), cited in World Meteorological Organization 2023).

There are several direct risks to production and consumption. These include declining crop yields under heat and water stress (FAO Regional Office for Africa 2009); shortened crop growing seasons;[9] shrinking acreage of arable land (Prowse and Braunholtz-Speight 2007; Owusu et al. 2021); higher incidence of crop pests (FAO Regional Office for Africa 2009), such as the desert locust invasion in East Africa in 2019 (Stone 2020); inundation of cropland and erosion (Müller et al. 2011); and flood-induced damage to agriculture-related infrastructure (IPCC 2014). The indirect effects are equally impactful. They include reduced labour productivity of farm workers, whether due to harsh climatic conditions[10] or to illness as vector-borne diseases proliferate (Fouque 2020) and disincentive effects leading some farmers to abandon their farms altogether (though, equally, food scarcity due to declining yields could increase food prices and result in farmers earning more).

The International Food Policy Research Institute (IFPRI) has modelled the effects of climate risks on food systems (IFPRI 2017). The study uses the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT),[11] along with standard assumptions about changes in population, income and climate, to make a set of baseline projections on food production, consumption and trade, and the prevalence of hunger. Selected findings are summarised in Table 3.1. Overall, food production in Africa is forecast to be 8.6 per cent lower under a representative climate change scenario (relative to the counterfactual of no climate change).[12] North Africa and Central Africa

Table 3.1: Impact of climate change on food production by 2050 (as % of projected production level without climate change)

	Africa	West Africa	Central Africa	East Africa	Southern Africa	North Africa
Aggregate food	−8.6	−7.2	−11.2	−8.8	−3.2	−13.6
Cereals	−7.9	−10.0	−5.6	0.0	9.5	−19.4
Fruits and vegetables	−13.1	−10.2	−18.5	−11.6	−19.0	−15.4
Oilseeds	−6.8	−6.4	−12.5	0.0	−50.0	−14.3
Pulses	−6.7	−12.5	0.0	11.1	0.0	0.0
Roots and tubers	−7.3	−5.4	−10.0	−15.0	0.0	11.1

Source: Authors' calculations based on IFPRI (2017).

would be most severely affected, with aggregate food production declining by 13.6 per cent and 11.2 per cent, respectively. At the other end, the Southern Africa region is projected to be less affected, with agricultural output expected to decline by just 3.2 per cent by 2050.

These findings are consistent with a study by Dasgupta and Robinson (2022) of 83 countries across four regions, Africa, Americas, Asia and Europe. The study finds that climate change has been responsible for reversing some of the improvements in food security that would otherwise have been realised, with the highest impact in Africa.

Across crops, fruits and vegetables are the most vulnerable to rising temperatures. The output of fruits and vegetables is projected to fall by over 13 per cent. Cereals are estimated to decline by 7.9 per cent.

Wheat, as discussed in this chapter, is especially sensitive to warming. As noted above, at current warming trends, by 2050, wheat yields in Africa are expected to fall by 15 per cent from levels over the period 1980 to 2010 (Pequeno et al. 2021).

Country-level studies show similar dramatic effects on crop yield or output. Empirical studies for Angola, Lesotho and Mozambique (Hunter et al. 2020), Cameroon (Molua 2008) and South Africa (Calzadilla et al. 2014) illustrate the adverse effects of climate change on agricultural yield and food security, although the outcomes vary across climate change scenarios, sectors and countries.

As noted above, meat and poultry are also at risk. In a global study, Thornton et al. (2021) project that livestock species in many parts of the tropics and some temperate zones would come under extreme heat stress by 2100, challenging the viability of outdoor livestock production systems. Anecdotal evidence of farmers switching to more drought-tolerant livestock species or breeds in Southern Africa confirms that climate change is already impacting livestock in the region (Dzama 2016).

Climate change is also connected to increasing pests. The 2019–2020 locust infestations in Ethiopia, Kenya and Somalia, which affected 1.25 million hectares of land, could be a warning of what is to come. It was also noted in this chapter that rising sea levels, temperatures and acidity are altering ocean, coastal and inland waterbodies ecosystems and displacing fish stocks. A World Bank study estimates that West and Central African countries such as Côte d'Ivoire, Liberia, DRC, Gabon and Sao Tome and Principe could see their maximum catch potential decrease by 30 per cent or more by 2050 (World Bank 2019). In East Africa, ocean warming has already destroyed parts of the coral reef (Lovei 2017).

Adaptation and mitigation

Emerging adaptation and mitigation efforts were illustrated in our discussion of the basic foods. Promising innovations are being developed to support adaptation and resilience-building in food systems while increasing agricultural productivity. These strategies could be classified into three groups:

autonomous adaptation, adoption of climate-smart technologies and transformational changes, and behavioural changes, including through trade policies and shifts in diet (Nhamo et al. 2019).

Autonomous adaptation involves incremental approaches based on learning-by-doing at the level of individual farmers or agricultural traders (Vermeulen et al. 2018), such as altering inputs (seed varieties, fertilisers) to improve resilience to heat or drought; changing the timing or location of cropping activities; using water more effectively and managing soil moisture; and adopting better pest, disease or weed management practices (IPCC 2007). However, incremental adaptation may be insufficient to address rapid or unexpected climate-induced shifts in agricultural production. These changes call for climate-smart technologies like altering the resource (land, labour, capital, technology) mix or the outputs and outcomes (the types and amounts of agricultural production) (Vermeulen et al. 2018). Trade can also help countries adapt to extreme weather events that destroy crops and reduce food supply. As a short-term palliative, food imports can make up for the shortfall of production or any nutrient gap (FAO 2018).

A review of nationally determined contributions (NDCs) submitted by African countries to the UN Framework Convention on Climate Change reveals a spectrum of adaptation and mitigation measures that are related to agriculture.[13] Most of the adaptation measures are in the domain of autonomous adaptation and relate to four common themes: the implementation of early-warning systems (e.g. Angola, Namibia, Zambia, Zimbabwe); water management (e.g. Botswana, Eswatini, Madagascar); crop management including diversification and adoption of drought-resistant varieties (e.g. Angola, Burkina Faso, Madagascar, Sao Tome and Principe, Zambia, Zimbabwe); and infrastructure development, which is included in almost every NDC. In relation to mitigation, the renewable energy sector is strongly prioritised in the NDCs.

However, these transitions are expensive, which is why finance has been such an important part of global climate discussions. It is estimated that US$2.8 trillion will be needed from 2020 to 2030 to implement NDCs in Africa, as discussed in Chapter 4 in the context of resources required to support agricultural development. Mitigation accounts for two-thirds of reported climate finance needs for the period 2020–2030, distributed across the following four sectors: transport (58 per cent), energy (24 per cent), industry (7 per cent) and agriculture, forestry, and other land use (AFOLU, 9 per cent). Adaptation represents 24 per cent of total climate finance, even though, for Africa, adaptation, rather than mitigation, remains the dominant priority. This is why the African climate negotiators placed strong emphasis on adaptation finance at the 2023 Conference of the Parties (COP 28). African governments have committed to contributing 10 per cent of the total cost of climate action. This means that US$2.5 trillion (or an average of US$250 billion annually) needs to be mobilised externally. In 2020, Africa's climate finance flows, both domestic and international, came to only US$30 billion, or about 12 per cent of estimated requirements. These issues are discussed in greater detail in Chapter 4.

Summary

This chapter has reviewed the main trends in the production and consumption of eight basic foods, detailing how production of these foods in Africa have generally underperformed in relation to global output despite nominal growth in production. Food production growth rates have trended below population growth. Consumption has outstripped production of every product except yams. These insights brought into view the underlying dynamics not only on Africa's status as a net food importer but also on the headline data on severe food insecurity and undernourishment. This analysis also highlights the regional variations in production and consumption. Similarly, distinctions were made between different uses to which five of the basic foods – rice, wheat, cassava, maize and yams – are put.

Cassava and yams are tropical crops that are competitively produced in the African regions concerned. Unlike rice, wheat and maize or beef and poultry, which benefit from significant subsidies in richer countries with trade-distorting effect, the comparative advantage of the African cassava- and yam-producing countries remains dominant. The paradoxical effect of subsidies that disincentivise production elsewhere while also making food more widely available are further discussed in Chapter 9 on the WTO legal framework.

This analysis has further highlighted the varying effects of climate change on production of basic foods and in particular rising temperatures and extreme weather variations. African countries have prioritised a variety of adaptation and mitigation measures in their NDCs, but financing continues to be contentious. At the same time, agricultural activities contribute to Africa's total emissions. For example, enteric fermentation of ruminant livestock and irrigated rice farming practices are significant contributors to methane emissions and other GHGs. More broadly, land as a central and important input in the agricultural value chain is simultaneously a source and a sink of carbon emissions. For cassava, yams, rice, maize and wheat, the result of research into adaptation strategies is being applied, although it is also clear that underinvestment in these food systems is a constraint. In the case of livestock, adaptation measures include better grazing land management, improved manure management, higher-quality feed, use of breeds and genetic improvement. Technology and infrastructure feature prominently among mitigation measures.

Notes

[1] Nevertheless, movement away from agriculture could explain why food production is causing the continent's population (and economic) growth to lag. The share of the African labour force employed in agriculture shrank from 2011 to 2019, but food prices and yields have been increasing recently (Roser 2023; Okou, Spray and Unsal 2022). This could suggest that food production is lagging economic growth because fewer

Africans are engaged in it than before, but it is still maintaining its share in GDP because of price rises.

[2] We can think of the food balance sheet in terms of the total quantity of foodstuffs produced in a country added to the total quantity imported and adjusted to any change in stocks that may have occurred since the beginning of the reference period. This gives the supply available during that period. On the utilisation side, a distinction could be made between the quantities exported, fed to livestock, used for seed, put to manufacture for food use and non-food uses, losses during storage and transportation, and food supplies available for human consumption.

[3] Other uses include seed for the next cycle of production, non-food (industrial) uses, processed food, and losses during storage, transportation and processing.

[4] In Asia, the picture is mixed. Africa has higher yields than Bhutan and the Philippines, slightly lower yields than Malaysia (Africa's yield is 95 per cent of Malaysia's) and much lower yields than Japan (which has almost three times Africa's yield). However, Japan's yam production is dominated by the Chinese yam, whereas the rest of the world mainly grows the White Guinea yam. This difference in which yams are grown may, at least in part, explain the difference in yields (Hamaoka et al. 2022; IITA n.d.).

[5] Urbanisation apparently contributes to rice demand by providing better-paid income-earning opportunities, increasing the opportunity cost of time spent on food production. Rice is quick and easy to prepare relative to staple foods, which is why urbanisation is contributing to increased demand for rice (Rutsaert, Demont and Verbeke 2013). For more perspective on rice research and development see: https://www.africarice.org.

[6] According to FAOSTAT they produced 15.3, 12, 10, 7.6 and 6.7 million MT of maize, respectively, in 2020.

[7] Other producers include Sudan, Kenya, Zambia, Zimbabwe and Libya.

[8] The NEPAD agency Fisheries and Aquaculture Programme presents a comprehensive analysis of issues in the sector: (*The NEPAD Agency Fisheries and Aquaculture Programme* 2022).

[9] Ofori, Cobbina and Obiri (2021) estimate that the growing period may be reduced by an average of 20 per cent, resulting in a 40 per cent drop in cereal yields.

[10] Rohat et al. (2019) project that the number of people exposed to 'dangerous heat' in Africa could increase by a multiple of 20–52, reaching 86–217 billion person-days per year by the 2090s.

[11] The IMPACT model is an interlinked system of climate, water, crop and economic models designed to explore the effects of changes in climate and other factors on agricultural production, trade and food security (International Food Policy Research Institute 2017).

[12] The climate change scenario assumes the IPCC's representative concentration pathway (RCP) 8.5 and the Hadley Centre Global Environment Model version 2-Earth System general circulation model.

[13] The NDCs are available from the NDC registry: https://unfccc.int/NDCREG

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