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Malawi’s Agrifood System

Transformation and Environmental Impacts

Xinshen Diao, Joachim De Weerdt, Peixun Fang, Eleanor Jones, Joseph Nagoli, Karl Pauw, and James Thurlow

1. Introduction

This paper is an update of Country Brief 8 in the series of *Agrifood System Diagnostics* coauthored by De Weerdt et al. (2023). The important addition from the previous country brief is a new section assessing agriculture’s environmental footprint, focusing on water use and greenhouse gas (GHG) emissions by subsector and over time. Unlike the previous version, this brief does not include a forward-looking analysis—using IFPRI’s Rural Investment and Policy Analysis (RIAPA) model (IFPRI 2023)—of the contribution of productivity growth in agricultural value chains on agrifood transformation, employment, and socioeconomic outcomes. For a recent and extensive value chain ranking analysis that incorporates RIAPA modeling results, readers are referred to Pienaar et al. (2023).

Malawi experienced slow growth in the post COVID-19 pandemic period. In addition to the economic impacts of the pandemic itself, the country suffered from high levels of public debt and a sustained balance of payments crisis. Global events such as the Russia-Ukraine conflict and adverse weather events such as Cyclone Freddy and the El Niño in 2023–2024 further prevented the Malawi economy from returning to prepandemic growth levels. Economic growth rates have dropped from an average of 4.1 percent in 2011–2019 to 2.2 percent since 2020 (World Bank 2025), with an average growth rate of 3.8 percent per year during 2009–2022.

The economy’s poor performance in recent years, together with Malawi’s growing population, means that the share of the population living below the basic-needs poverty line remained stagnant at about 50 percent, while the absolute number of poor people increased by more than 2 million (Caruso and Cardona Sosa 2022). Poverty is concentrated in rural areas, where smallholder agriculture dominates. The rural population growth rate slowed down slightly in recent years but remains above 2.5 percent annually (National Statistical Office 2024), which continues to push smallholder farmers to expand cultivated land and increases pressure on land and water resources. Average landholdings decreased from 0.8 hectares (ha) per farming household in 2010/11 to 0.7 ha in 2019/20 (Benson and De Weerdt 2023), and this trend has not been reversed after 2019/20.

With farming currently at the center of economic life for most rural Malawians and more than 80 percent of the population residing in rural areas, transforming the country's agrifood system (AFS) through higher agricultural productivity and diversification to higher-value agricultural products continues to be important for raising household incomes. A growing share of value added is generated in the off-farm segments of agrifood value chains and is therefore becoming more important for creating jobs and income-earning opportunities for rural households (De Weerdt et al. 2023).

We situate Malawi's AFS in this broader social and economic background and describe its current structure and transformation progress in Section 2. We then decompose the AFS into value chain groups in Section 3 to understand their different roles and evaluate their performance and contribution to AFS growth and transformation. With the AFS's increasingly important role in ensuring environmental sustainability, we assess the current and changing water footprints and GHG emissions of different agriculture subsectors in Section 4. Section 5 concludes by summarizing the main findings and likely focus of policies aimed at jointly achieving agrifood growth, food security, and environmental sustainability.

2. Structure and Dynamics: The Agrifood System in the Broad Economy

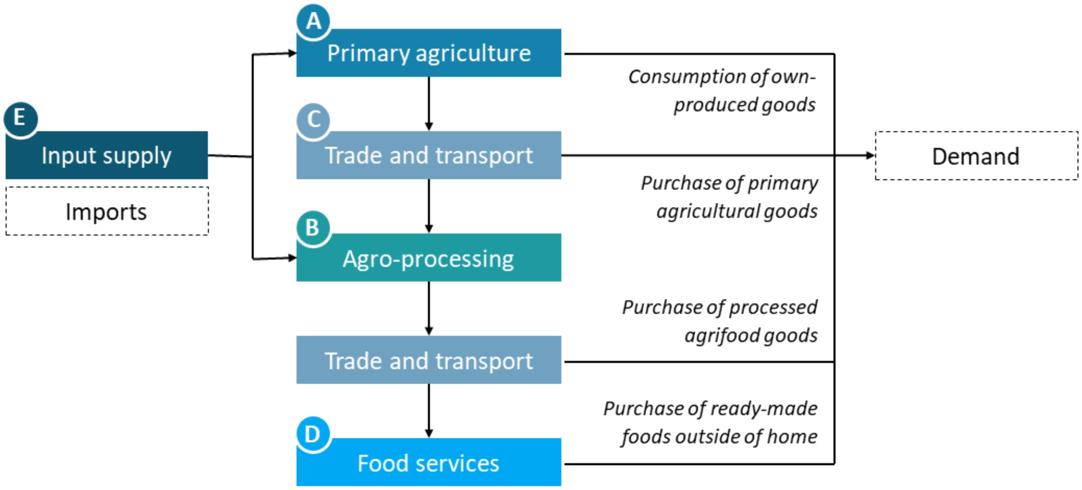
AFSs are complex networks of actors who are connected by their roles in supplying, consuming, and governing agrifood products and jobs. Just as economies transform when they develop, AFSs evolve and modernize over time (Diao et al. 2010; Timmer 1988; De Janvry and Sadoulet 2019). Agriculture is at the center of an AFS, and subsistence farming typically dominates agriculture during the earlier stages of transformation. The agriculture sector serves as an engine of rural—and even national—economic growth and development in these stages. Rising agricultural productivity provides the initial impetus for agricultural transformation as it allows farmers to produce a marketable surplus. This leads to market development and creates incentives for rural infrastructure investments, allowing agriculture and the broader AFS to become more diversified and commercialized. Gradually, economic activity and job opportunities shift to the nonfarm economy, both within and outside the AFS (Haggblade, Hazell, and Dorosh 2007).

Urbanization and continued expansion of the nonfarm economy play more dominant roles in propelling AFS development in the later stages of economic transformation, while urban and rural nonfarm consumers fuel demand for more agricultural output, provided via supply chains and value chains that integrate rural areas with towns and cities (Dorosh and Thurlow 2013). The exact nature of AFSs' evolution varies across countries because of their diverse economic structures and the growth trajectories of their various agrifood and nonfood subsectors. The pace of their transformation also differs, often impacted by multiple external drivers, including biophysical, environmental, political, economic, and demographic ones (Fanzo et al. 2020).

2.1 Conceptual Framework of the Agrifood System

In this brief, we apply a simple conceptual framework of the AFS to measure its structure and size from the supply ~~or demand~~ side using a set of economywide data such as national accounts, employment statistics, agricultural production statistics, and international trade data. Our framework decomposes the AFS into five components that include agriculture and four broad off-farm components, labeled as A to E in Figure 1 (see Thurlow et al. 2025). *Primary agriculture* (A) comprises economic activities for the agriculture sector including crops, livestock, fisheries, and forestry. *Agro-processing* (B) is part of the manufacturing sector for agriculture-related food or nonfood products. *Trade and transport services* (C) covers services associated with transporting, trading, and logistics for agrifood products moving between farms, firms, and final points of sale to reach consumers. *Food services* (D) is for meals preparation services at restaurants, food stalls, and hotels. Finally, *input supply* (E) is the portion of domestically produced nonagrifood manufacturing goods and services used in agricultural and agro-processing production as intermediates, such as fertilizers for farming, electricity for agro-processing, or financial services for trading of agrifood products.

Figure 1. A simple conceptual framework of the AFS



Source: Thurlow et al. (2025).

This conceptual framework is used to measure the size and structure of Malawi's AFS from a supply-side perspective focusing on AFS gross domestic product (GDP) and employment. Following the definitions of Thurlow et al. (2025), AFS GDP is the aggregation of value additions generated from the five components of the AFS (A to E), while AFS employment is the total number of persons employed across those components. The structure of AFS GDP and employment differs at the various stages of development, and both indicators can be important for tracking transformation progress within a country or for cross-country comparisons (Diao et al. 2024). A transforming economy, for example, will typically be characterized by more rapid growth in the off-farm components of the AFS.

2.2 Current Structure of Malawi's Agrifood System

Table 1 presents the current structure of Malawi's AFS in 2022 based on official national accounts data (NSO 2024), which are compiled in a Social Accounting Matrix (SAM) for Malawi for 2022 (IFPRI 2024), and on sectoral employment statistics (ILO 2025). National estimates are broken down into AFS and the "rest of the economy" components, while AFS GDP and employment are further dis-aggregated into their on-farm (primary agriculture) and (combined) off-farm components (Figure 1).

The GDP and employment estimates for national industry and services are provided at the bottom of the table. The industrial sector includes mining, manufacturing, construction, electricity, and water supply in the national accounts, while the service sector includes both private and public services. The national manufacturing (a subsector of industry) and trade and transport (part of private services) activities are also included. As such they provide a perspective on the relative size of the agro-processing (B) in national manufacturing and off-farm trade and transport AFS components (C) within the broader trade and transport sector. The final column of the table shows the GDP per worker, a measure of labor productivity.

Table 1. GDP and employment in Malawi's agrifood system and total economy (2022)

	GDP		Employment		GDP per worker
	Value (US$ billion)	Share (%)	Workers (million)	Share (%)	Value (US$)
Total economy	**11.6**	**100**	**7.6**	**100**	**1,525**
Agrifood system	**5.6**	**48.1**	**5.8**	**75.5**	**971**
Primary agriculture (A)	3.4	29.4	4.7	61.9	879
Off-farm AFS	**2.2**	**18.7**	**1.0**	**13.6**	**2,087**
Processing (B)	0.9	8.3	0.2	3.1	4,026
Trade and transport (C)	0.8	7.1	0.7	8.7	1,252
Food services (D)	0.1	0.5	0.1	1.1	752
Input supply (E)	0.3	2.8	0.1	0.7	6,015
Rest of economy	**6.0**	**51.9**	**1.9**	**24.4**	**3,240**
Total industry	**2.1**	**18.6**	**0.6**	**8.0**	**3,438**
Total manufacturing	1.3	11.5	0.3	3.9	4,443
Total services	**6.1**	**52.6**	**2.3**	**30.1**	**2,663**
Total trade and transport	2.0	17.5	1.5	19.2	1,392

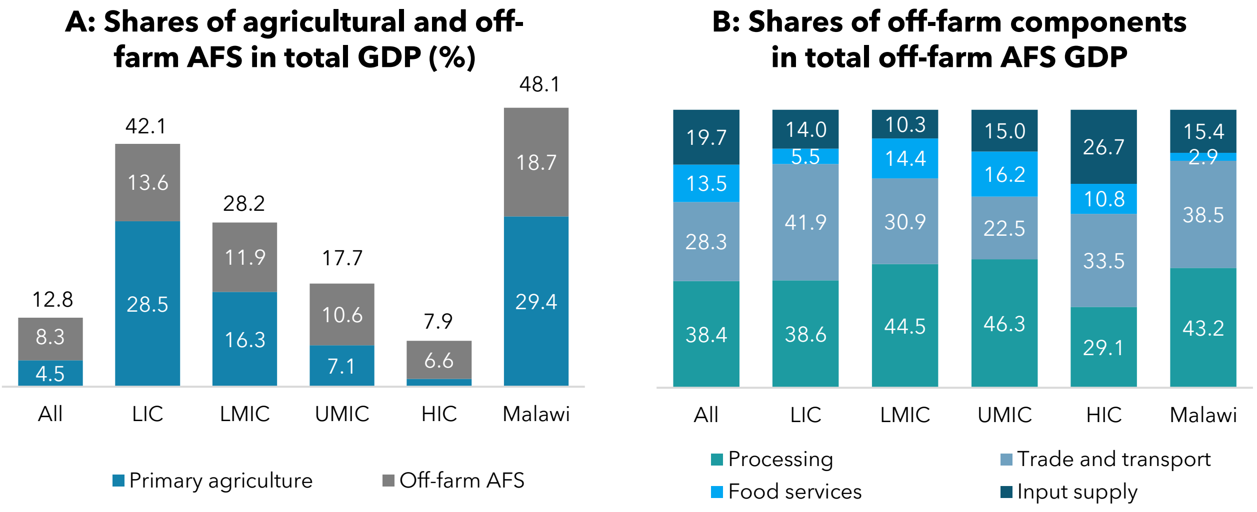
Source: GDP estimates from Malawi's national accounts data (National Statistical Office of Malawi, 2024) and IFPRI's Malawi 2022 Social Accounting Matrix (2024); employment estimates from ILO data (2025).
Notes: (1) A to E corresponds to the five agrifood system (AFS) components from Figure 1.
(2) Primary Agriculture + Off-farm AFS + Rest of economy =100
(3) Primary Agriculture + Total industry + Total services =100

The AFS accounted for 48.1 percent of Malawi's national GDP and 75.5 percent of employment (Table 1). Primary agriculture alone contributed 29.4 percent of GDP and 61.9 percent of employment, while the four off-farm components of the AFS contributed 18.7 percent to GDP and 13.6 percent to employment. The off-farm components therefore accounted for less than 40 percent of total AFS GDP and less than 20 percent of AFS employment. GDP per worker (or labor productivity) is higher in most of the off-farm components than in primary agriculture (for example, agro-processing labor productivity is four times that on the farm). The movement of farm workers into certain off-farm components—a natural feature of agricultural transformation—is expected to benefit households through higher-paying jobs and new income-generating opportunities.

2.3 Comparing Malawi's Agrifood System to Other Countries

The structure and economic contribution of AFSs typically evolve as countries pass through different stages of economic development. This is demonstrated in Figure 2, which compares the average AFS structures of low-income countries (LICs), lower- (LMICs) and upper-middle-income countries (UMICs), and high-income countries (HICs). Estimates for Malawi, an LIC, are included for comparison. The share of the AFS in total GDP equals the sum of agricultural and off-farm components in Figure 2 (Panel A). Malawi's agriculture GDP share is similar to the LIC average, but its off-farm component is relatively larger. As a result, Malawi's total AFS share of GDP is around 5 percentage points higher than the LIC average. Within the off-farm AFS GDP (Panel B), Malawi's agro-processing is relatively larger than that of the LIC average. Malawi's manufacturing sector accounts for 11.5 percent of GDP (Table 1), of which more than 70 percent is agro-processing, dominated by basic processing. For instance, the bulk of Malawi's tobacco crop undergoes a simple process called stemming whereby the main vein of the leaf is removed, an activity that accounts for nearly 10 percent of agro-processing GDP. Others basic processes include maize and rice milling (30 percent of agro-processing GDP). Other key processing subsectors include fruit processing, slaughtering of animals, fish processing, and animal feed production, with the latter becoming more important in Malawi given the relatively large and established poultry subsector and rapid growth in the pig subsector.

Figure 2. Comparing Malawi's AFS to other countries (2022)


A: Shares of agricultural and off-farm AFS in total GDP (%)

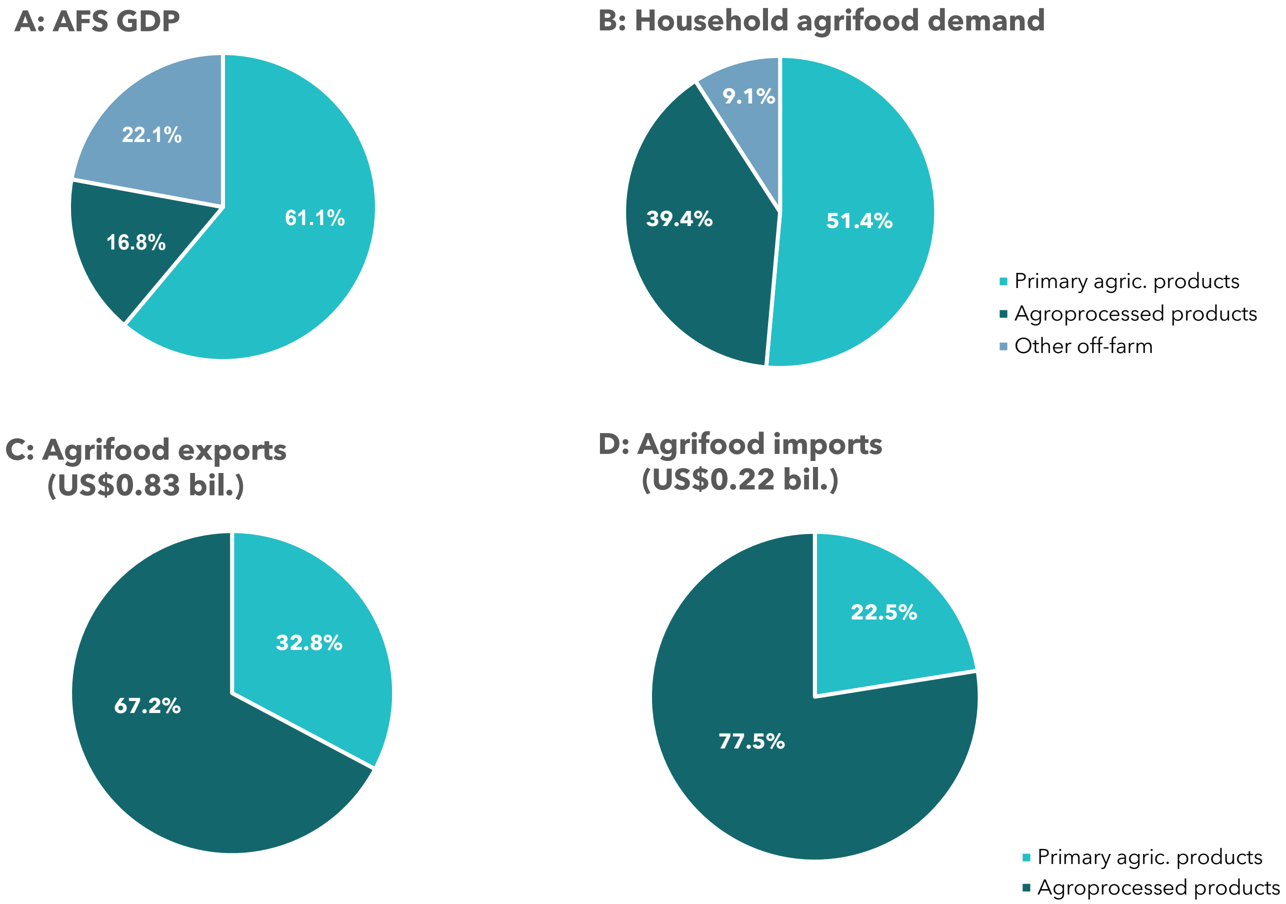
B: Shares of off-farm components in total off-farm AFS GDP

Source: IFPRI's Agrifood System Database (Thurlow et al. 2025) and the 2022 SAM for Malawi (IFPRI 2024).
Note: LIC = low-income country; LMIC = lower-middle-income country; UMIC = upper-middle-income country; HIC = high-income country.

2.4 The Demand Side of Malawi's Agrifood System

The GDP contributions discussed in the previous section define the structure of the AFS from a supply-side perspective. We can also consider the AFS from the demand side; that is, household consumption demand. A comparison of the AFS's supply and demand sides (Figure 3, Panels A and B) shows that processed agrifoods account for a much larger share of agrifood demand (39.4 percent) than the agro-processing sector contributes to AFS GDP (16.8 percent).

Figure 3. Composition of AFS GDP, household demand, and trade (2022)



Source: Authors' calculation based on the 2022 SAM for Malawi (IFPRI 2024).

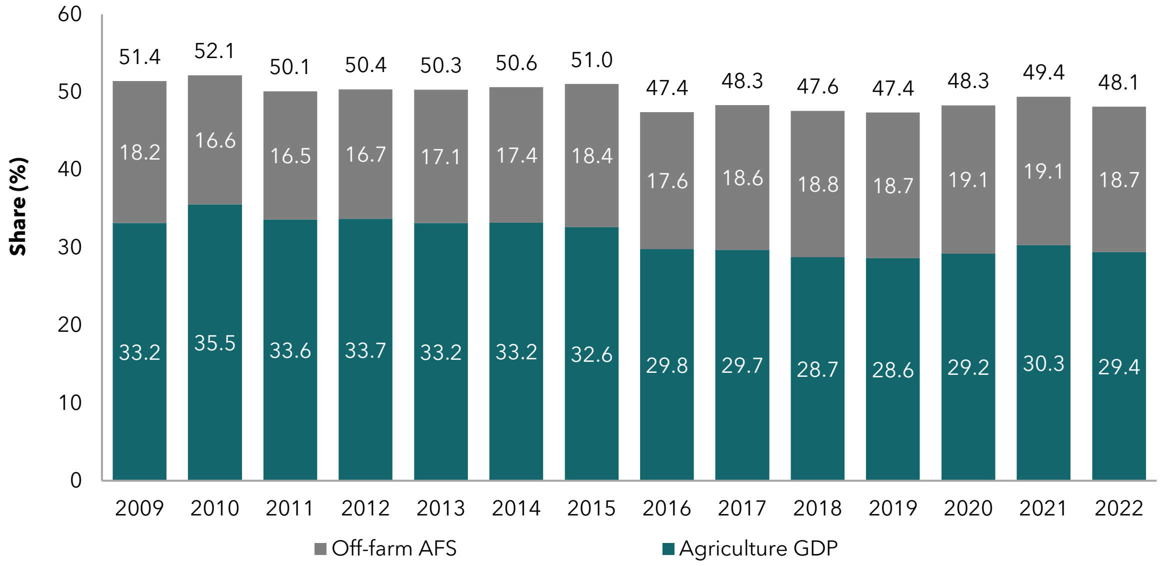
The differences between the composition of AFS GDP and agrifood consumption can be explained by agrifood trade (Panels C and D). As an LIC with limited natural resources that can be exported, Malawi exports more agrifood products than it imports. These exports help raise the foreign exchange required to finance imports, especially of nonfood manufacturing products. Tobacco accounts for about two-thirds of agrifood exports. More than 80 percent of exported tobacco is processed (the stemming process described earlier), which explains the high agro-processing share in agrifood exports (67.2 percent). Agro-processing products also account for a large share of agrifood imports (77.5 percent), although overall Malawi has a relatively large surplus on its agrifood trade balance (US$0.83 for exports versus US$0.22 billion for imports). Nevertheless, the country spends around US$0.17 billion on imported processed agrifood products, which is equivalent to 30 percent of foreign exchange earnings from tobacco exports. More detailed information about the contribution of agrifood value chains to production, consumption, and trade is included in Appendix I Table A2.

2.5 The Structural Transformation of Malawi's Agrifood System

The earlier subsections provide a snapshot of the current structure of Malawi's AFS in the context of the broader economy. As an LIC, agriculture still dominates the AFS in both GDP and employment. In this subsection, we assess recent trends in structural transformation within Malawi's AFS (2009–2022), focusing on changes in the composition of GDP and labor productivity growth. Economic growth and urbanization are associated with faster growth in nonagriculture sectors. Globally, many nonfarm jobs—including many in agro-processing and food-related trade and transport services—have higher rates of labor productivity than in farming. This is also true in Malawi, even though many of its agro-processing sectors consist of basic processing activities for domestic markets (for example, maize milling) or tobacco processing for exports. Therefore, the movement of farm workers into nonfarm sectors, and particularly into the off-farm components of the AFS, can still contribute significantly to growth and development in Malawi.

Figure 4 shows the shares of on-farm (agriculture) and off-farm AFS GDP in total GDP for the period 2009–2022. The agriculture GDP share declined modestly over this period, while the off-farm share remained stable. The drop in agriculture GDP share in 2016 reflects the impact of El Niño, which disproportionately impacted the agriculture sector (Anderson et al. 2023 explore how the more recent El Niño event affected Malawi's economy). On the other hand, the rising agriculture GDP shares in 2020 and 2021 reflect a period of successive shocks that affected the nonagricultural economy proportionally more than the agriculture sector. The slow pace of transformation of Malawi's AFS in 2009–2022 is unfortunate because it has become increasingly hard for rural households to make a living from primary agriculture alone (Benson and De Weerdt 2023).

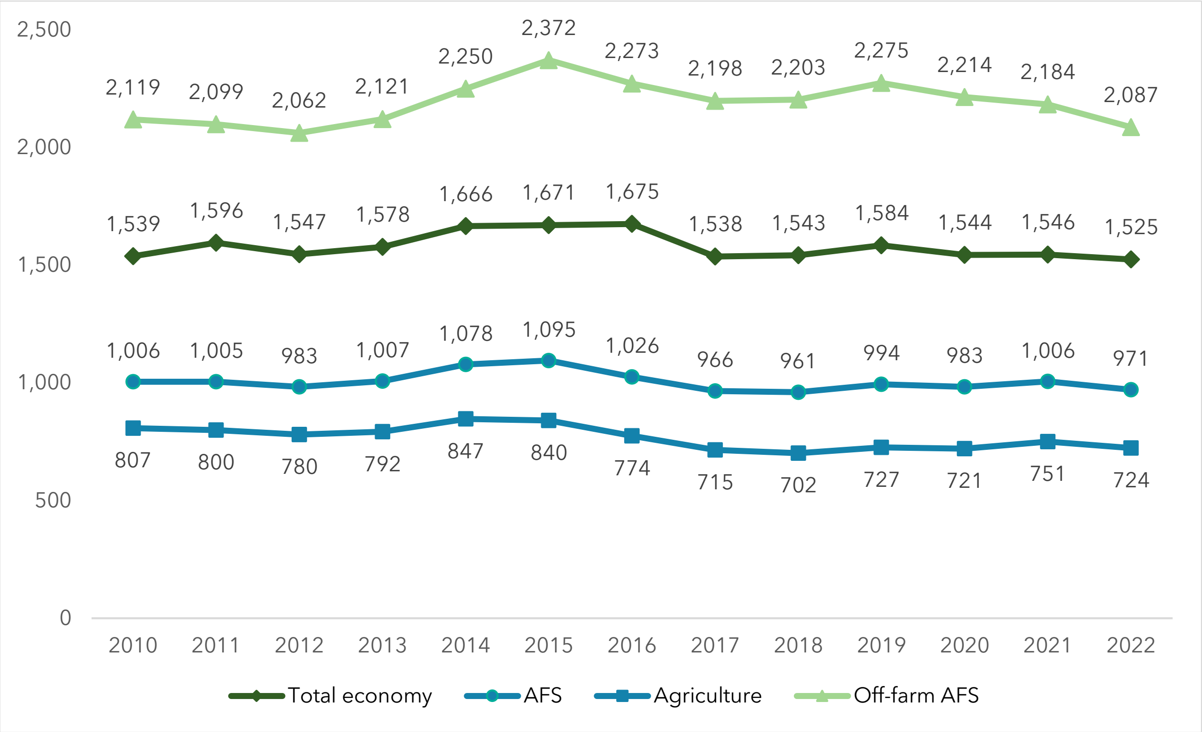
Figure 4. Shares of on- and off-farm AFS GDP in total GDP (2009–2022)



Source: Authors' calculation based on the 2009-2022 SAMs for Malawi (IFPRI 2024).

Figure 5 compares GDP per worker—or average labor productivity—across the different subcomponents of the AFS as well as for the whole economy. AFS GDP per worker remained mostly stagnant between 2010 and 2022. This lack of labor productivity growth is indicative of a lack of structural change—as was also evident from Figure 4. Figure 5 further shows that labor productivity in the off-farm components of the AFS is significantly higher than in agriculture and the economy as a whole, but this measure too remained virtually unchanged over the analysis period. Stagnant labor productivity rates in primary agriculture means the impetus for agricultural transformation is lacking, while slow economic growth in the overall economy has been a major constraint to the movement of people from agriculture into nonfarm opportunities.

Figure 5. GDP per worker in Malawi's AFS and total economy (2009–2022)



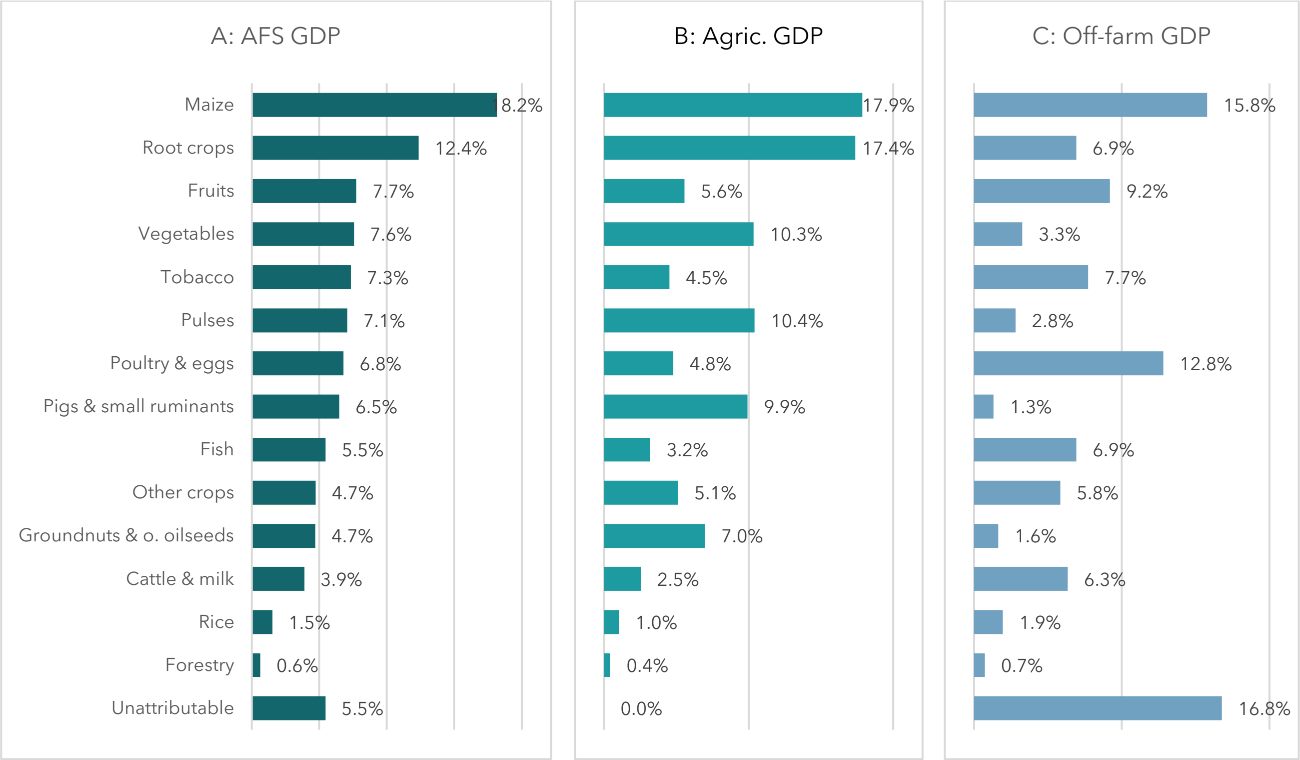
Source: Authors' calculation based on the 2009–2022 SAMes for Malawi (IFPRI 2024) and ILO (2025).

3. Disaggregating Malawi's Agrifood System Across Value Chains

3.1 Decomposing the Agrifood System

Following the conceptual framework of the AFS presented in Section 2, this section discusses the structure, performance, and contribution of agrifood value chains to the overall AFS. We decompose Malawi's AFS into 14 value chain groups. Table A1 in Appendix I shows how agriculture subsectors are mapped to these value chain groups. While our estimates of total AFS GDP (Table 1) are based on the national accounts data published by National Statistical Office of Malawi (2024), the disaggregation of agricultural and off-farm AFS GDP across the various agrifood value chain groups is based on a reconciliation of agricultural production data and industry input-output data in the most recent SAM (2022) for Malawi (IFPRI 2024). Figure 6 shows the estimated AFS GDP shares of the 14 value chains, ranked in descending order.

Figure 6. Value chain shares in total AFS, agriculture, and off-farm AFS GDP (2022)



Source: IFPRI 2022 SAM for Malawi (IFPRI 2024).

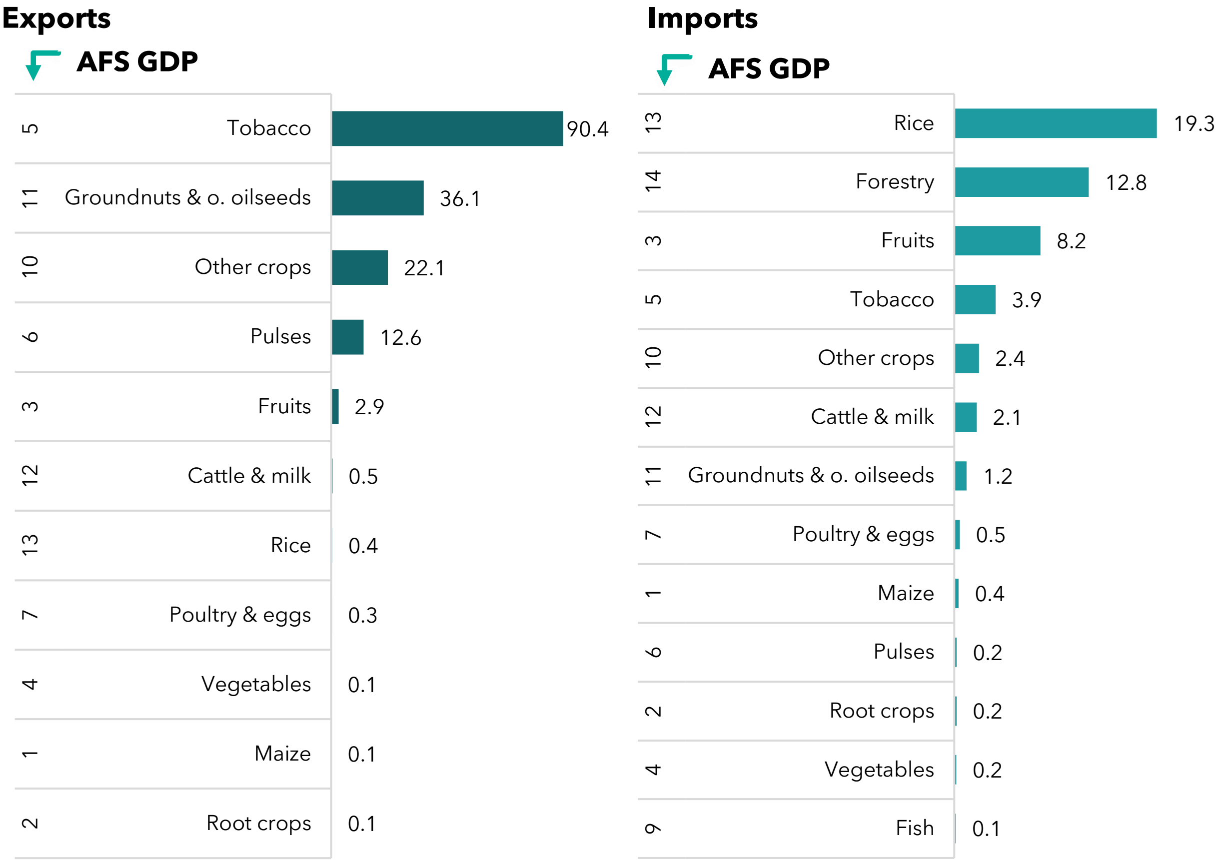
Maize has the largest value chain, accounting for 18.2 percent of AFS GDP in 2022. It also accounts for 17.9 percent of agriculture GDP and 15.8 percent of off-farm GDP. The off-farm component primarily includes value added from maize milling and trade and transport services associated with maize and maize flour. Root crops—which include key staples such as cassava, Irish potatoes, and sweet potatoes—comprise the second largest agrifood value chain in terms of AFS and agriculture GDP shares, but they have a relatively small share in the off-farm component of the AFS (6.9 percent), since root crops are mostly consumed with limited processing. The fruits and vegetables value chains rank third and fourth in the AFS. Although the on-farm share of fruits is smaller than that of vegetables, the fruits value chain is one of the larger subsectors in the off-farm AFS (9.2 percent) (Table A2 in Appendix I). Tobacco is ranked fifth overall, but this subsector too has a relatively larger off-farm component. In addition to undergoing processing, this highly traded product requires more trade and transport services than many other value chains.

3.2 Trade Dependency Across Value Chains

As discussed in Section 2.4, Malawi exported US$0.83 billion worth of agrifood products in 2022 and imported US$0.22 billion, generating a surplus of US$0.61 billion on its agrifood trade account. More than 10 percent of Malawi's agricultural and agro-processing outputs is typically exported, while less than 3 percent of domestic demand for agrifood products is met by imports. Agrifood exports further account for almost 70 percent of total exports and are therefore an important source of foreign exchange to finance imports, especially of nonagrifood products. Overall, however, the country still has a large trade deficit, estimated at US$1.44 billion in 2022.

Different value chains play different roles in Malawi's agrifood trade. Figure 7 shows the export-output and import-consumption ratios across the 14 value chain groups. The numbers on the far left of the charts indicate the ranks of value chains in AFS GDP as shown in Figure 6. Besides tobacco, two other value chain groups—groundnuts and other oilseeds, and other crops—have relatively large export shares, with export-output ratios of 36.1 percent and 22.1 percent, respectively, in 2022. The oilseed value chain includes both seeds and edible oil products. Malawi exports mainly unprocessed seed products while processed edible oil products are produced primarily for the domestic market and supplemented by imports (Table A2 in Appendix I). Although the oilseed value chain is a relatively small one (ranked 11th in AFS GDP), oilseed exports are second largest in AFS trade, equivalent to 20 percent of tobacco exports in 2022. The other crops value chain combines several smaller cash crops of which sugarcane is the largest, while tea dominates the value chain's exports. Tea exports accounted for about 10 percent of Malawi's total agrifood exports in 2022, ranking third after oilseed exports. The other crops value chain further includes coffee and cotton, both traditional export sectors in Malawi. Finally, Malawi exports some dried legumes, while most pulses are for domestic consumption. More detailed information about the structure of agricultural and processed food and the composition in trade and consumption can be found in Appendix I Table A2).

Figure 7. Export-output and import-consumption ratios across value chains (2022) (%)



Source: IFPRI 2022 SAM for Malawi (IFPRI 2024).
Note: The number to the left of the value chain's name represents its rank with respect to its share in AFS GDP, as per Figure 6. The export-output ratios are zero for the pig, fish, and forestry value chains, which are not included; the import-consumption ratio is also zero for the pig value chain.

The rice and forestry value chains are highly dependent on imports (Figure 7, Panel B). Rice accounts for more than 40 percent of Malawi's total agrifood imports and nearly 20 percent of total rice consumption. By comparison, on the production side, rice accounts for less than 2 percent of agriculture GDP. The forestry value chain is the smallest among the value chain groups constructed for the purpose of our analysis (less than 1 percent of AFS GDP). Most of the imports in this value chain are in the form of processed wood products.

Most of Malawi's value chains are largely trade-independent, with small export-output and import-consumption ratios (Figure 7). These less-traded value chains include many of the country's largest. For instance, maize, root crops, the three livestock value chains, fisheries, and two high-value food crops—fruits and vegetables—are all less trade-dependent. Together these value chains account for around 80 percent of AFS and agriculture GDP. The implication is that the domestic rather than the world market has a more important role to play in Malawi's AFS transformation.

3.3 Growth Across Value Chains

In this section, we assess the performance of different value chains to understand their contribution to broad AFS growth and transformation. Figure 8 shows that Malawi's AFS GDP grew by 3.3 percent per year during 2009–2022, while the total GDP growth rate was 3.7 percent. Within the AFS, agriculture GDP grew slowly at 2.9 percent, while the off-farm components grew much faster (4.0 percent).

Figure 8. Annual growth rates of AFS GDP, agriculture GDP, and off-farm AFS GDP by value chain, (2009–2022) (%)

Source: IFPRI 2009–2022 SAMs for Malawi (IFPRI 2024).

However, growth was unevenly distributed across value chains. Five value chains recorded growth rates of over 5 percent per year, including two livestock and three food crop value chains. With the imperative of diversifying away from burley tobacco, the tobacco value chain's GDP fell significantly. The on-farm tobacco GDP fell by 7.1 percent and its off-farm GDP fell by 2.9 percent per year during 2009–2022. Reduced tobacco land was reallocated to pulses and oilseeds, which saw rapid expansion in cultivated areas. Despite these significant structural shifts, tobacco value added per ha remains much higher than for food crops. While diversification from tobacco to food crops is expected to have positive effects on nutrition and the environment, its impact on AFS GDP growth could be negative unless Malawi can significantly raise the land productivity of its major food crops. Taking maize as an example, maize yields were stagnant around two metric tons per ha over the period 2009–2022.

Figure 8 shows that the growth rate of the AFS's off-farm component was much higher than its on-farm component, resulting in important structural changes within the AFS. The maize value chain serves as a good example. In 2009 its off-farm components accounted for about 34 percent of the value chain's GDP, while by 2022 that share had increased to 45 percent. For food crops in total, the off-farm components were about 30 percent in 2009, increasing to 35 percent by 2022.

4. Agriculture's Environmental Impacts

In this section, we assess agriculture's environmental impacts, focusing on its water footprint and GHG emissions. The environmental footprint of agriculture is primarily driven by land-use change, water use, and GHG emissions. Measuring water footprints helps assess how the agriculture sector *uses* and *affects* water resources through both consumption and pollution, thus reflecting the pressure agricultural production places on freshwater resources. It is typically categorized into three components. The green water footprint refers to the volume of rainwater consumed by crops during the growth cycle and by livestock animals. While green water use is not extractive, comparing it across crops highlights differences in water-use efficiency. Making better use of rainwater can enhance productivity in rainfed systems.

The blue water footprint refers to the volume of surface and groundwater consumed—rather than merely withdrawn—in agricultural production, including irrigation for crops, and water for livestock and aquaculture. Blue water use may strain limited irrigation supplies. Lastly, the grey water footprint refers to the volume of water needed to dilute pollutants for water quality to meet environmental standards. The grey water footprint serves as a proxy for water pollution from agriculture, reflecting the potential impact of production practices on freshwater ecosystems. A higher grey water footprint generally indicates more intensive use of chemical inputs—primarily fertilizers, herbicides, and pesticides—and a greater risk of water contamination.

Water footprints vary across agricultural products due to differences in water requirements, input intensity, production practices, and local environmental conditions. In summary, while blue and grey water footprints often reflect clear environmental pressures—such as water scarcity and water quality degradation—green water use is more context-specific. Together, these indicators offer comparative insights into resource use and environmental trade-offs across agricultural systems, especially when evaluated alongside GHG emissions. The agricultural water footprint data reported in this section are sourced from Mekonnen and Hoekstra (2010a, 2010b).

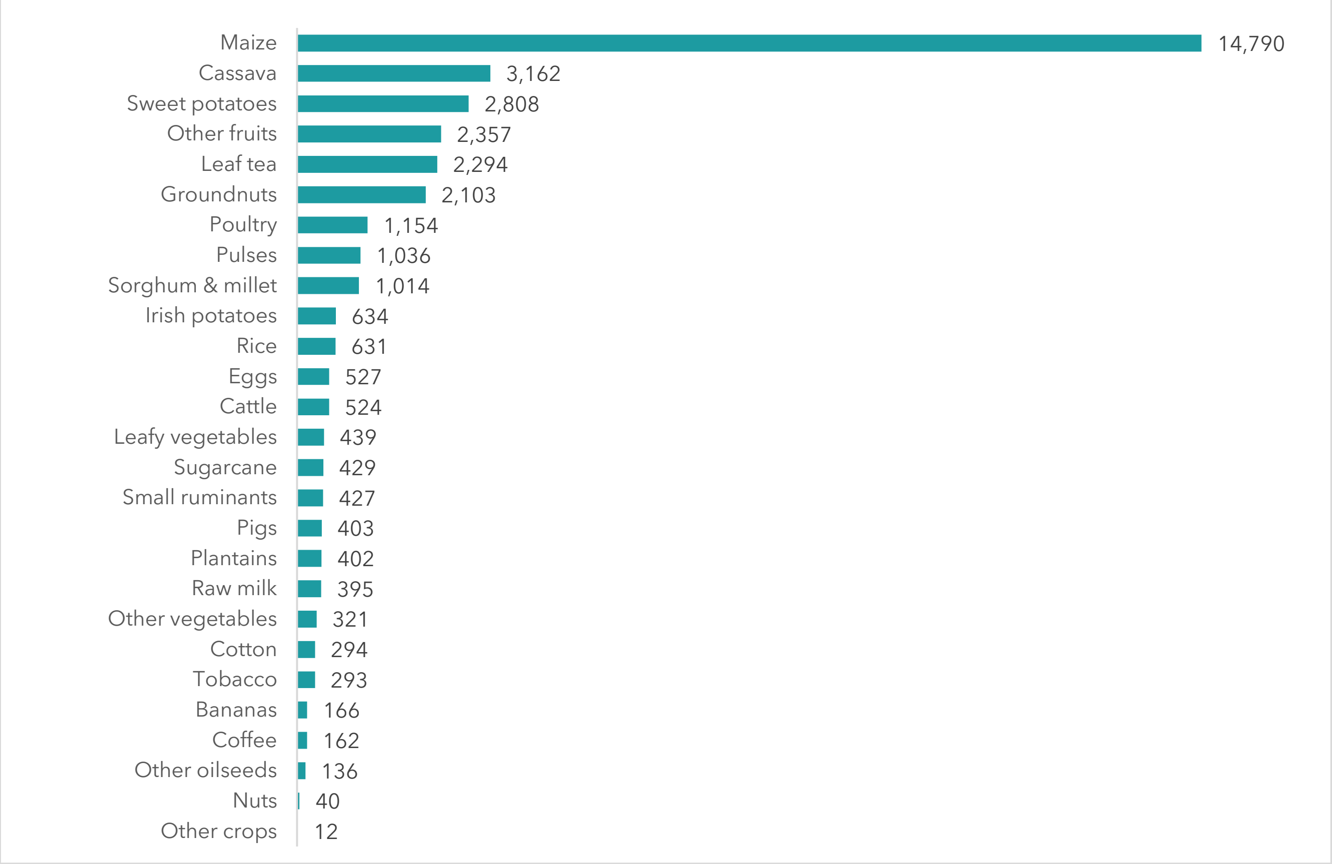
Agricultural GHG emissions are measured in carbon dioxide equivalents (CO_2e), which combine the warming effects of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These emissions originate directly from farming activities, including crop cultivation, livestock rearing, and aquaculture. Major sources include livestock digestion, manure management, rice paddies, and the use of synthetic fertilizers. Agricultural GHG emission data are from FAO (2025) and Poore and Nemecek (2018).

4.1 Agriculture's Water Footprint

Green water (rainwater) is a dominant component of total water footprints in many countries. Globally, nearly 80 percent of agricultural water footprints are made up of rainwater consumed in crop growth. Agriculture in Malawi is primarily rainfed, so it is not surprising that more than 90 percent of its water footprint is from rainwater use. Water footprints for individual crops are influenced by crop characteristics and production yield, and the total area allocated to that crop's production. Additional factors include fertilizer use, which increases the grey water footprint, and irrigation, which determines the blue water footprint. In livestock production, water footprints are determined by certain animal characteristics, productivity in animal production, and the scale of production.

Figure 9 presents the current level of total water footprint by agriculture subsector. Maize is the largest crop in Malawi, making up roughly 40 percent (15 billion cubic meters) of Malawi's total agricultural water footprint in 2022. This is followed by cassava, sweet potato, fruits, tea, and groundnuts, which together account for about 35 percent.

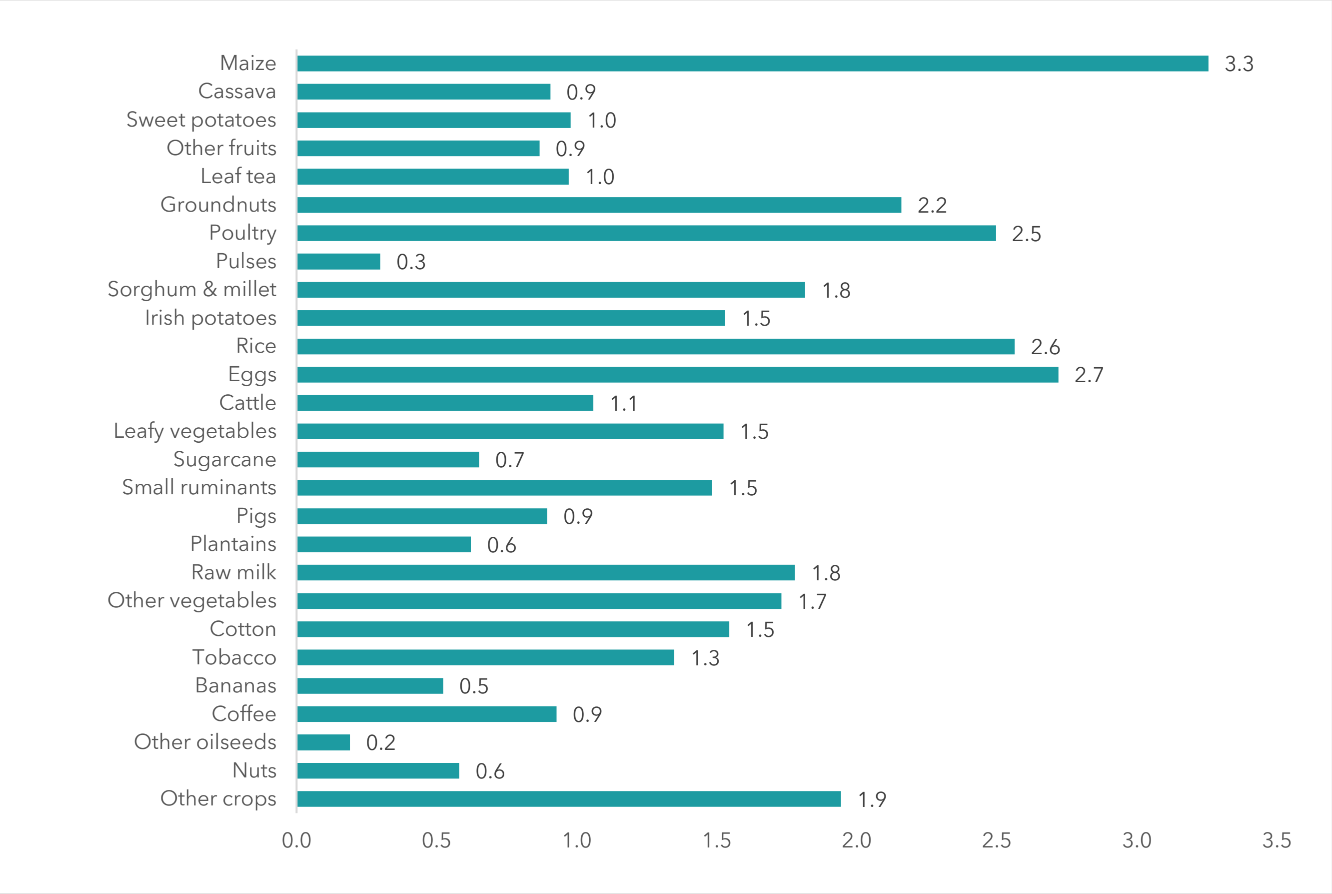
Figure 9. Total water footprint by agriculture subsector (2022) (million cubic meters)



Data sources: Water footprint data per unit of agricultural output are from Mekonnen and Hoekstra (2010a, 2010b) and agricultural production data are for 2022 and from FAO.

We next compare Malawi's water footprint against the global average per ton of the same product. This provides an indication of the relative water use efficiency of Malawi's different agriculture subsectors. For maize, the global average is about 1,200 cubic meters of water per ton of maize produced, of which nearly 1,000 cubic meters are from rainwater use. By comparison, Malawi uses nearly 3,700 cubic meters of rainwater per ton. This means the ratio of maize water use per ton of output in Malawi to the global average is 3.3. Figure 10 reports these ratios for all crops in Malawi. As is the case for maize, water footprints for several other crops and livestock products in Malawi also exceed the global average, with ratios well above 1.0. This includes groundnuts (2.2), sorghum and millet (1.8), Irish potatoes (1.5), and rice (1.3). Some crops are as or more efficient than the global average. For instance, water footprint ratios for cassava (0.9), sweet potato (1.0), fruits (1.0), and tea (1.1) are comparable to global averages.

Figure 10. Ratio of water footprint per unit product to the global average (global average per unit product = 1.0)

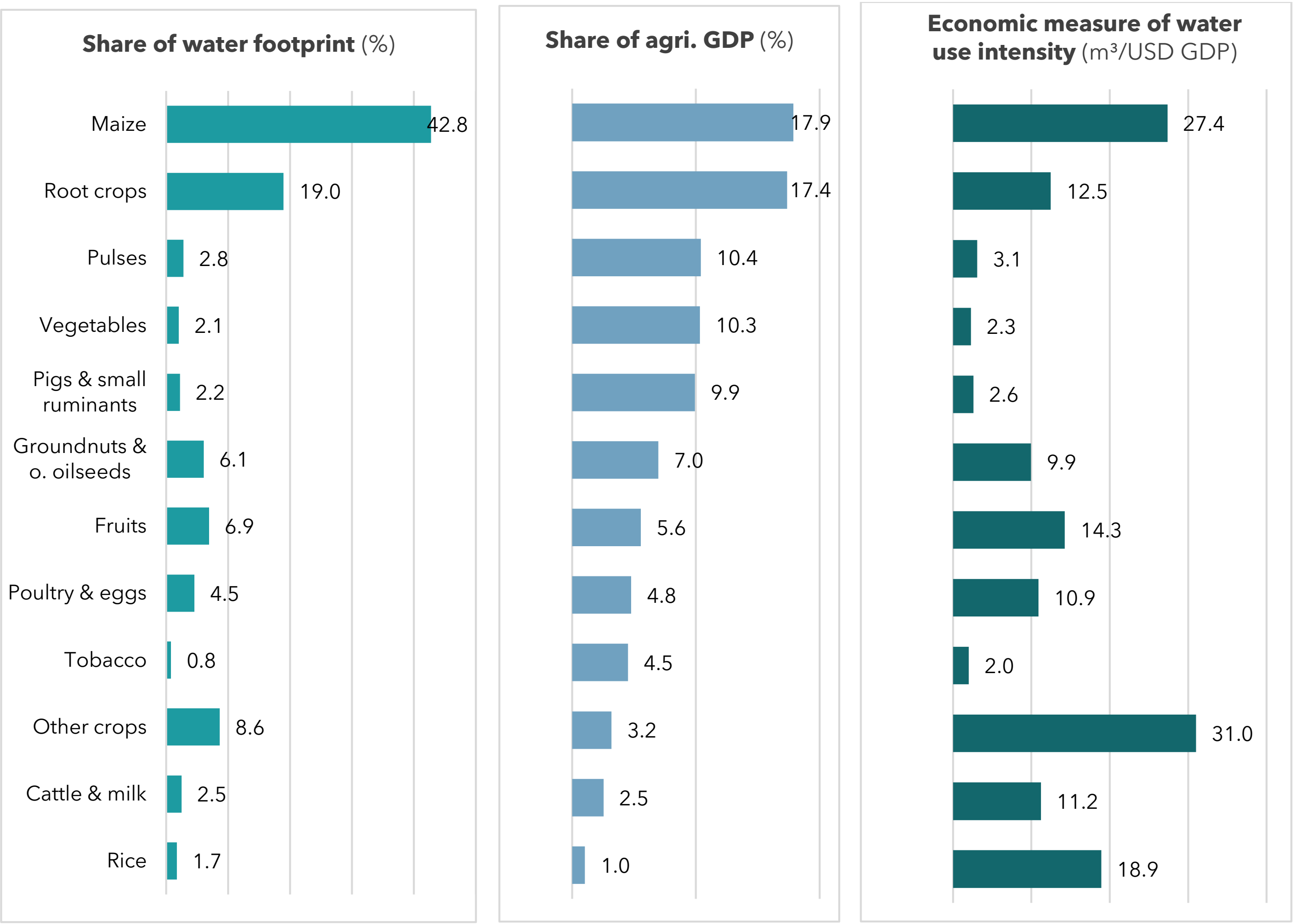


Data sources: Water footprint data per unit of agricultural output are from Mekonnen and Hoekstra (2010a and b) and agricultural production data are for 2022 and from FAO.
Note: For the groups of agricultural products (for example, "other fruits" or "small ruminants"), the global average considers only the crop and livestock product items that are produced in Malawi for reasons of comparison.

While rainwater use is not extractive, rainfall over cropland is not "free" in ecological terms. High green water footprints often reflect low-yield systems that use more land and are characterized by higher water footprints per unit of food, which contributes to agricultural expansion into forests, wetlands, or marginal lands (Rockström, Lannerstad, and Falkenmark 2007). In Malawi, agriculture is both the backbone of rural livelihoods and the main user of land and water resources. The country experiences rainfall variability and dry spells, increasing the risk of green water scarcity during critical stages of crop growth. Deforestation for agriculture is a key driver of land degradation, biodiversity loss, and reduced carbon sequestration (Gibbs et al. 2010). Thus, continued reliance on extensive, low-yield systems may undermine watershed health, reduce long-term ecosystem resilience, and increase vulnerability to food insecurity.

Water productivity can be assessed by comparing a subsector's share in the total agricultural water footprint with its contribution to agriculture GDP. We use aggregated water footprints for the same value chain groups defined in Figure 6 for the comparison. Maize is the major food crop in Malawi, contributing significantly to both agriculture GDP and water use. Although maize is about 18 percent of agriculture GDP, its cultivation generates more than 40 percent of the sector's water footprint (Figure 11). This suggests that maize is more water use-intensive per unit of economic output compared to the agriculture sector average. Each dollar of maize GDP corresponds to a water footprint of 27.4 cubic meters, whereas the sector average is 11.4 cubic meter per dollar of agriculture GDP, represented by the vertical line in the third panel of Figure 11.

Figure 11. Shares of water footprint and agriculture GDP and economic measure of water use intensity by value chain



Data sources: Water footprint data per unit of agricultural output are from Mekonnen and Hoekstra (2010a and b), agricultural production data are from FAO, and agriculture GDP data are from IFPRI's Malawi 2022 SAM.
Note: The value chains are presented in descending order of share in agriculture GDP.

This disproportionate share of water used in maize production does not necessarily impose a direct cost on value chain actors or the economy, especially since most of the water used is rainwater, but it does underscore the vulnerability of maize production to rainfall variability and drought. In a rainfed system like Malawi's, high water dependency implies that maize yields and thus food security are strongly influenced by weather conditions. From a policy perspective, and in the context of a rainfed AFS, understanding water productivity can help identify crops that may offer greater resilience to climate shocks as well as opportunities for diversifying production into less vulnerable crops.

Some food crops demonstrate a relatively balanced relationship between their shares in water use and economic contributions. Root crops, for instance, account for 19.0 percent of the agricultural water footprint and contribute a comparable 17.4 percent to agriculture GDP, indicating water use efficiency near the agriculture sector average. Pulses make up 10.4 percent of agriculture GDP and use considerably less water—only 3.1 cubic meters per dollar of GDP—highlighting their efficiency in water use. Oilseeds and rice also appear balanced in terms of water intensity and agriculture GDP contribution. Certain cash crops like fruits and vegetables are either relatively balanced in water use or more water efficient.

Taken together, these food and cash crops—along with pigs, small ruminants, poultry, and eggs—offer promising avenues for lowering vulnerability to weather shocks to support agricultural growth, food security, and dietary diversity. In this context, examining water productivity does not imply penalizing crops for using rainwater, but rather emphasizing crop mixes that could strengthen resilience and optimize resource use in Malawi's rainfed agriculture.

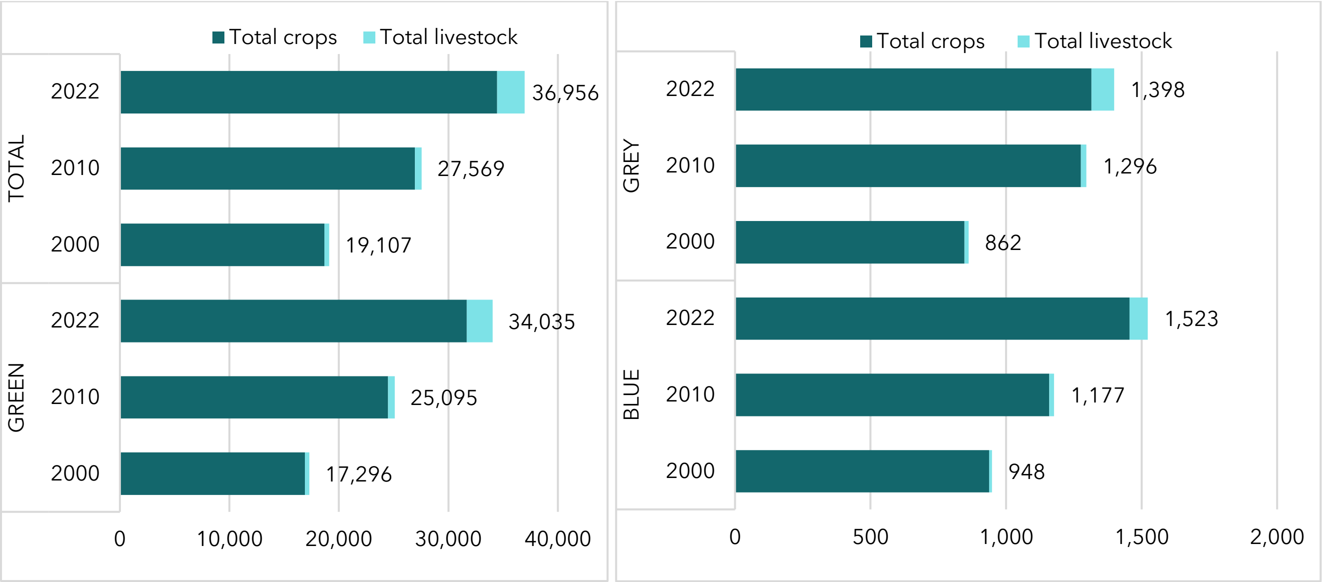
Malawi's water footprint is mainly from rainwater consumed (92 percent). The blue water (from irrigation) and grey water footprints (associated with fertilizer use) contribute only around 4 percent each to the total water footprint in agriculture. Figure 12 presents Malawi's agricultural water footprints in 2000, 2010, and 2022, disaggregated into green, blue, and grey components, and shown separately for crops and livestock. Over this period, the total water footprint nearly doubled, from 19.1 billion to 37.0 billion cubic meters, growing by 3.0 percent annually. This growth outpaced population growth (2.9 percent per year), indicating increased agricultural water use per capita.

More than 90 percent of agricultural water use comes from crop production. While maize is the most important crop and uses more water, other crops such as sweet potato and groundnuts also experienced rapid growth in water use. Livestock production, though small in terms of its total water use, recorded the fastest expansion in its water footprint, growing nearly sixfold between 2000 and 2022.

The blue and grey water footprints remain small in absolute terms but have grown rapidly. Tea accounts for one-half of the increase in blue water use due to its use of irrigation, while maize is responsible for one-half of the growth in grey water given that most fertilizer in Malawi is used for maize cultivation. The sharp rise in the grey water footprint, though modest in absolute size, highlights a growing concern around agricultural water pollution, particularly with respect to fertilizer and agrochemical runoff. If left unmanaged, growth in grey water use could lead to water quality degradation with consequences for public health and ecosystems. Monitoring grey water growth can help identify emerging pollution hotspots and guide targeted intervention.

Taken together, the data in this section show that Malawi's agricultural water use is rising faster than population growth. Without improvements in water efficiency and better management of water pollution, agricultural growth could place mounting stress on both water quantity and quality. The policy priority is not to avoid high-water-use crops or value chains, but to promote practices and agricultural diversification that aim at improving water productivity, controlling pollution, and lowering weather vulnerability in Malawi's rainfed agricultural system.

Figure 12. Agriculture's water footprints in 2000, 2010, and 2022 (million cubic meters)



Data sources: Water footprint data per unit of agricultural output are from Mekonnen and Hoekstra (2010a and 2010b); agricultural production data are from FAO (2025).

4.2 Agriculture's Greenhouse Gas Emissions

Malawi's primary agriculture GHG emissions at the farmgate are estimated around 9–10 million tons CO_2e. These emissions include those from crop farming and aquaculture and livestock production activities. Emissions in the broader AFS include those from upstream and downstream activities such as fertilizer production, food processing, transportation, agriculture-driven deforestation, and food loss and waste. Total AFS emissions are estimated at 19 million tons CO_2e and account for 70 percent of national GHG emissions (FAO 2025).

Malawi contributes only 0.05 percent to global GHG emissions. This is due not only to its low levels of industrialization and energy use intensity, but also to its small population and economic size. On a per capita basis, Malawi's emissions are less than one-fifth of the global average, and far below those of high-income and rapidly industrializing countries. Historically, global climate change has been driven primarily by cumulative emissions from fossil fuel use and land-use change in industrialized nations, with rapidly industrializing emerging large economies becoming increasingly significant contributors in recent decades (den Elzen et al. 2013). In contrast, Malawi's emissions have remained almost negligibly small, shaped by subsistence agriculture and population-driven land pressure rather than fossil fuel-intensive development.

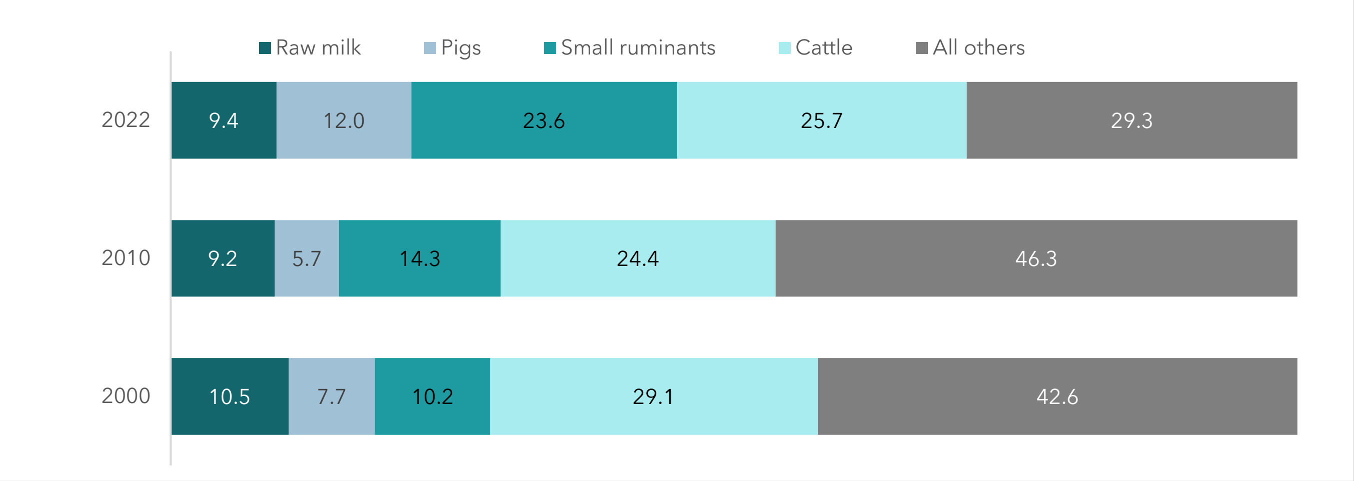
While Malawi's total emissions are miniscule in global terms, their structure is highly distinctive. As noted, the AFS accounts for over 70 percent of national GHG emissions, far above the global average of 17 percent. This reflects not only agriculture's dominant role in Malawi's economy, but also the relatively limited size of sectors such as energy, industry, and transport, which are typically associated with large emissions. As a result, agriculture is the main driver of environmental pressure in Malawi's emissions profile, making it the critical focus area for any environmental efforts.

The FAO's GHG emission data cover the period 1990–2022. Globally, GHG emissions from on-farm agriculture continued to rise over this period, albeit at a modest pace. Emissions from land use, land-use change, and forestry (LULUCF) declined both in absolute and relative terms, falling from around 25 percent in the 1990s to 17 percent today. Growth in global emissions has therefore primarily been driven by fossil fuel-intensive nonagricultural activities.

In Malawi, by contrast, the share of on-farm agricultural emissions in total GHG emissions remained consistently high, while emissions from LULUCF increased, albeit slowly and becoming relatively stable in recent years. Emissions from on-farm agricultural activities passed those from LULUCF in recent years, with agriculture becoming the driver of emissions growth in the country. This shift reflects an increase in the environmental impact of Malawi's AFS. With expanding livestock and input-intensive crop production, this trend is likely to continue, especially in the absence of significant improvement in input-use efficiency, land productivity, and sustainable farming practices.

Within the agriculture sector, livestock is a major contributor to emissions around the world, mainly from enteric fermentation and animal waste. According to the FAO's GHG emissions data, livestock generate about 7 billion tons CO_2e per year globally, accounting for nearly 90 percent of all agricultural emissions. Livestock emissions are also relatively high in Malawi, accounting for over 70 percent of agricultural emissions. Figure 13 shows the share of emissions originating from four livestock subsectors and the rest of agriculture combined in 2000, 2010, and 2022. The total share of livestock emissions increased from less than 60 percent in 2000 and 2010 to more than 70 percent in 2022. Emissions from cattle are largest, ranging from 25–30 percent, while emissions from small ruminant and pig production rose sharply, from 10.2 and 7.7 percent, respectively, in 2000 to 23.6 and 12.0 percent in 2022.

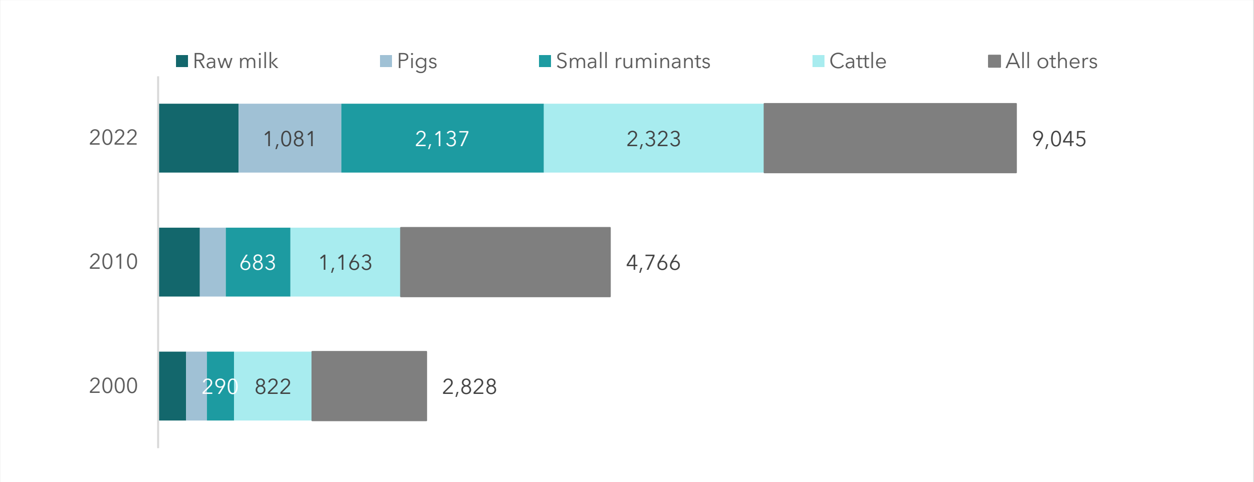
Figure 13. Shares of total agricultural GHG emissions in 2000, 2010, and 2022 (%)



Data sources: Authors' calculation based on FAO and various other data sources.

Not only is agriculture a dominant source of GHG emissions in Malawi, but its GHG emissions have also grown rapidly. Figure 14 presents agriculture GHG emission levels in 2000, 2010, and 2022. Agricultural emissions more than tripled from 2.8 million tons CO_2e in 2000 to 9.0 million tons in 2022, with substantial increases across all livestock subsectors. Although pigs do not emit enteric methane at the same intensity as cattle and small ruminants, the sharp rise in pig production meant emissions from this subsector increased from 217,000 tons in 2000 to over 1 million tons in 2022. Emissions from small ruminants (goats and sheep) also grew rapidly, rising from 290,000 tons to 2.1 million tons. Because cattle meat and milk production did not grow as rapidly as other livestock production, cattle emissions growth was slower, reaching 2.3 million tons in 2022, up from 822,000 tons in 2000.

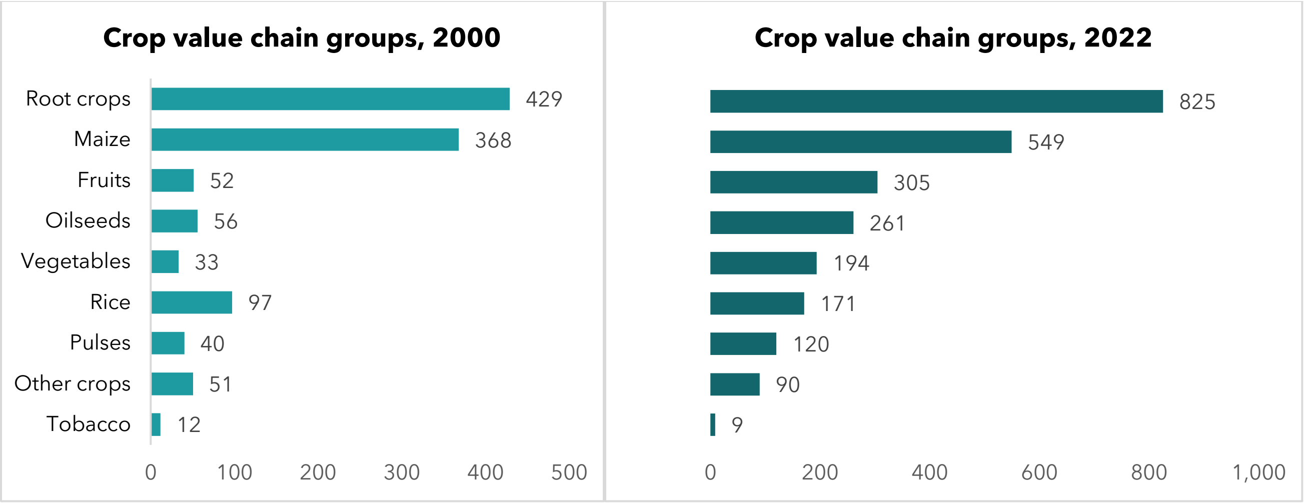
Figure 14. Total agricultural and livestock GHG emissions (1,000 metric tons)



Data sources: Authors' calculation based on FAO and various other data sources.

Figure 15 reports emissions by crop subsector. Although total crop production emissions more than doubled from 1.1 million to 2.5 million tons CO_2e between 2000 and 2022, their share in total agricultural emissions declined and account for only about one-fifth of total agricultural emissions in 2022. Among the subsectors, emissions from root crops increased most in absolute terms (396,000 tons), while those from fruits and vegetables grew most in relative terms (an almost sixfold increase). Maize is another large emitter, which together with root crops accounted for around 70 percent of emissions in the crops subsector in 2000, although with increased crop diversification this share fell to 54 percent by 2022.

Figure 15. Crops GHG emissions by subsector (2000, 2022) (1,000 metric tons)



Data sources: Authors' calculation based on FAO and various other data sources.

5. Summary

Even in the decade prior to the COVID-19 pandemic, Malawi achieved only modest economic growth. Since the pandemic, an economic turnaround has eluded the country, and growth continued to be slow, hampered not only by high levels of public debt and a sustained balance of payments crisis, but also by global events such as the Russia-Ukraine conflict and adverse weather events such as Cyclone Freddy and El Niños. Agrifood system (AFS) GDP grew by 3.3 percent per year during 2009–2022, below that of the national economy (3.8 percent). Within the AFS, primary agriculture grew at 2.9 percent, only slightly above the population growth rate. The slow growth in the agriculture sector and in the AFS was accompanied by stagnant labor productivity growth and almost no change in the AFS's structure over this period.

Nevertheless, five value chains—including two livestock and three food crop value chains—grew over 5 percent per year during 2009–2022, indicative of the uneven growth experience across value chains. The large decline in GDP in the tobacco value chain, which is linked to ongoing efforts to diversify away from tobacco, is expected to have positive effects on nutrition and the environment, but could have negative implications for AFS growth and household incomes given tobacco's importance as a high-value export crop. These adverse effects can be minimized by ensuring that the land productivity of other food and export crops is increased significantly.

Our analysis shows that Malawi's AFS is not highly dependent on the international market. Most food crops and livestock sectors primarily serve domestic markets. Household demand and changing consumption patterns are therefore key demand-side drivers for AFS growth and import competition. Some food crops—like groundnuts, other oilseeds, and dried beans—are also produced for export. Diversifying Malawi's agricultural export base is not only important for AFS growth, but also imperative given the country's large trade deficit and persistent foreign exchange shortages.

With respect to the AFS's environmental footprint, the analysis reveals that agriculture's water footprint and GHG emissions have grown rapidly. Two-fifths of agriculture's water footprint is from maize, while more than 70 percent of GHG emissions are from livestock. Water use intensity in the maize subsector is higher than Malawi's agricultural average, while on a per unit output basis its water footprint is more than three times the global average. Although rainwater use is not extractive, rainfall over cropland is not "free" in ecological terms. High green water footprints often reflect low-yield systems that use more land and water per unit of food, which contributes to agricultural expansion into forests, wetlands, or marginal lands. A sharp rise in the country's grey water footprint, albeit still modest in absolute terms, highlights a growing concern around agricultural water pollution. If left unmanaged, it could lead to water quality degradation with consequences for public health and ecosystems. Globally, livestock generate 15 percent of total GHG emissions, but in Malawi they contribute 40 percent.

Policies to reduce agriculture's environmental footprint need to take into consideration the country's low-income status and limited fiscal space, as well as a need to align environmental gains with higher agricultural productivity, increased resilience, and less vulnerability to food insecurity. Diversifying into water-use efficient crops and adopting certain agricultural practices could help lower the risks of weather shocks on food insecurity. Promoting both water and land productivity and reducing postharvest losses will likely have low-cost and high-impact policy outcomes.

About the Authors

Xinshen Diao is a Senior Research Fellow, **Peixun Fang** is a Senior Research Analyst, **Eleanor Jones** is a Program Manager, **Karl Pauw** is a Senior Research Fellow, and **James Thurlow** is the Director of IFPRI's Foresight and Policy Modeling Unit, all based in Washington, DC.

Joachim De Weerdt is a Senior Research Fellow and Program Leader, and **Joseph Nagoli** is a Senior Research Coordinator in IFPRI's Development Strategies and Governance Unit.

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Appendix I

Table A1. Value chain groups and their corresponding agriculture subsectors

Value chain groups and their share of AFS GDP	Individual value chains (or agriculture subsectors) in the group and their share of the group's agriculture GDP
Maize (18.2%)	Maize 95.5% | Sorghum & millet 4.5%
Rice (1.5%)	Rice 99.8% | Wheat & barley 0.2%
Groundnut & oilseeds (4.7%)	Groundnuts 75.3% | Other oilseeds 24.7%
Pulses (7.1%)	Pulses 100%
Roots (12.4%)	Cassava 39.5% | Irish potatoes 20.7% | Sweet potatoes 37.7% | Plantains 3.2%
Vegetables (7.6%)	Leafy green vegetables 70.4% | Other vegetables 29.6%
Fruits & nuts (7.7%)	Nuts 2.5% | Bananas 31.8% | Other fruits 65.8%
Tobacco (7.3%)	Tobacco 100%
Other crops (4.7%)	Sugarcane 61.5% | Cotton 7.8% | Tea 25.8% | Coffee 3.1% | Other crops 1.8%
Cattle & dairy (3.9%)	Cattle meat 48.5% | Raw milk 51.5%
Poultry & eggs (6.8%)	Poultry meat 63.8% | Eggs 36.2%
Pigs & small ruminants (6.5%)	Small ruminants 35.7% | Other livestock 64.3%
Fish (5.5%)	Aquaculture 3.4% | Captured fish 96.6%
Forestry (0.6%)	Forestry 100%

Source: Authors' calculation based on the 2022 SAM for Malawi (IFPRI 2025).

Table A2. Shares of value chain groups in AFS GDP, household consumption, and trade

	GDP share			HH consumption share			AFS export share			AFS import share		
	Agric.	Proc.	Agric+proc	Agric.	Proc.	Agric+proc	Agric.	Proc.	Agric+proc	Agric.	Proc.	Agric+proc
All products	100	100	100	100	100	100	100	100	100	100	100	100
Maize	17.9	11.3	16.5	7.2	36.3	19.8	0.2	0.4	0.3		5.5	4.3
Rice	1.0	1.6	1.2		11.5	5.0		0.2	0.1	81.3	34.6	45.1
Root crops	17.4	0.1	13.7	21.4	0.3	12.3		0.2	0.1		1.0	0.8
Pulses	10.4	0.4	8.2	9.8	0.4	5.7	20.7	0.0	6.8		0.6	0.5
Groundnuts & o. oilseeds	7.0	1.0	5.7	4.2	0.9	2.8	38.0	0.0	12.5		1.5	1.2
Vegetables	10.3		8.1	15.9		9.0	0.3		0.1	2.5		0.6
Fruits	5.6	11.5	6.8	6.6	14.9	10.2	3.1	0.9	1.6	2.9	29.9	23.8
Tobacco	4.5	9.6	5.6		0.9	0.4	32.9	81.3	65.4	9.6	2.3	3.9
Other crops	3.2	10.7	4.8	2.0	10.5	5.7	4.2	16.5	12.4	3.7	6.8	6.1
Cattle & milk	2.5	7.4	3.6	5.0	11.8	8.0		0.4	0.3		7.1	5.5
Poultry & eggs	4.8	17.6	7.5	6.9	0.0	3.9	0.6	0.0	0.2		2.3	1.8
Pigs & small ruminants	9.9		7.8	16.9		9.6						
Fish	5.1	10.0	6.2	3.4	10.4	6.5					0.5	0.4
Forestry	0.4	0.9	0.5	0.6	0.5	0.5					5.0	3.9
Unattributable		22.9	4.9		1.7	0.8		0.1	0.0		2.8	2.2

Source: Authors' calculation based on the 2022 SAM for Malawi (IFPRI 2025).

Appendix II: Agriculture's Environmental Impact Data Sources and Methodology

Agricultural Water Footprint Data Sources and Methodology

Agricultural water footprint data per unit products are sourced from Mekonnen and Hoekstra (2010a) for crops and Mekonnen and Hoekstra (2010b) for livestock. Both publications are part of "Value of water research report series" published by UNESCO-IHE Institute for Water Education. The datasets in Excel format are the annexes of the research reports and are publicly accessible on www.waterfootprint.org/resources/appendix/Report47-Appendix.zip for crops and www.waterfootprint.org/resources/appendix/Report48-Appendix-V.zip for livestock. Both links allow users to download two zip files in which there are multiple other zip files or documents. The relevant Excel data files are "Report47-Appendix-II.xlsx" for crops and "Report48-Appendix-V.xlsx" for livestock.

The crops water footprint data per unit product in Mekonnen and Hoekstra (2010a) are generated from a high-resolution and grid-based model, while the animal products' water footprint data per unit product are calculated by required water in animal production processes. The detailed methodological explanations are provided in Section 2.1 "Method" of Mekonnen and Hoekstra (2010a) and (2010b). The water footprints are reported for 207 individual countries, including Malawi. The country data are at both national and subnational level (state, province, or district level), with the average for the period 1996–2005. The subnational level water footprint data for Malawi are at the district level, and the data for Malawi's country average are used in this study.

The original water footprint data are in per metric tons of agricultural crop and livestock products. We combined the water footprint data with FAO's annual agricultural production data to calculate Malawi's agriculture subsectors' water footprints in 2000, 2010, and 2022.

The global average water footprints per unit products are also included in Mekonnen and Hoekstra (2010a, 2020b). The global average water footprint for a group of products in this report (for example, water footprint for fruits, pulses, or oilseeds) was calculated from water footprints for individual products in the group that are grown in Malawi to make better comparable.

GHG Emission Data Sources and Methodology

FAOSTAT publishes a set of GHG emission datasets; for this study we primarily use the Emissions Intensities dataset. This dataset contains analytical data on the intensity of GHG emissions in kilograms CO_2e per kilogram of agricultural product and in kilotons (kt) CO_2e of the products for 13 agricultural commodities, which include: two cereals—rice, and other cereals excluding rice; five meat products—cattle meat, buffalo meat, big meat, goat meat, and sheep meat; four raw milk products—cattle milk, goat milk, sheep milk, and camel milk; and two poultry products— chicken and eggs. The dataset is at the country level and covers the period 1961–2022. For Malawi, the emission intensity data for pig meat are omitted, possibly because of lack of reliable inventory data due to low historical importance. In fact, the pig emission data are not available for most African countries, so we estimated pigs' emission intensity for this study. Unlike ruminant animals like cattle, sheep, and goats, pigs do not emit enteric methane, and therefore have an emission intensity level much lower than that of cattle and small ruminant animals for per unit meat output. Pigs in Malawi are commonly raised in semi-intensive or backyard systems, often with low-quality feed and slow growth, increasing their emission intensity relative to commercialized and more intensive systems. Emission intensity for pigs is thus estimated at around 30 percent of that of small ruminants for which data are available for Malawi.

The FAOSTAT emission data do not cover noncereal crops, and the GHG emissions per kilogram, taken from Poore and Nemecek (2018), are global averages.

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1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info