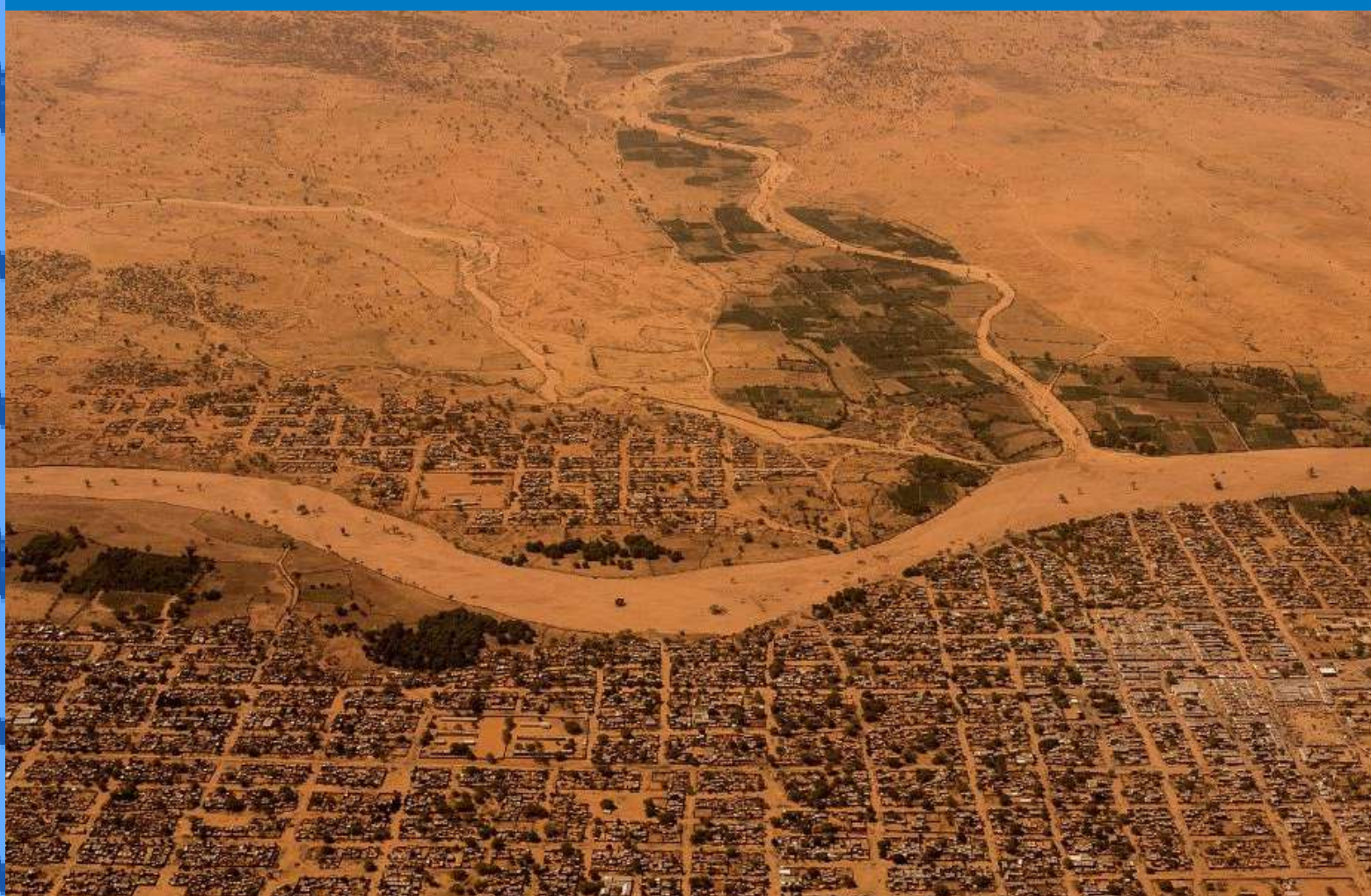


POLICY BRIEF

FEBRUARY 2026

Agriculture and water systems in Sudan: Opportunities for refugee and IDP integration

Frans Schapendonk, Martina Jaskolski, Mathieu Ouedraogo, Radhika Singh



CLIMATE
ACTION

FOOD FRONTIERS
AND SECURITY



Creative Commons License
CC BY-NC-ND 4.0 © 2026 CGIAR Climate Security

CITATION

Schapendonk, F.; Jaskolski, M.; Ouedraogo, M.; Radhika, S. (2026). Agriculture and water systems in Sudan: Opportunities for refugee and IDP integration. Brief. CGIAR Climate Security. Alliance of Bioversity International and CIAT. 38p

COVER PHOTO

Photo: Arial view of Zalingei, a town in Western Sudan and the capital of Central Darfur state. UN Photo/Pierre Galinier

CONTACT

CGIAR Climate Security
climatesecurity@cgiar.org
<https://climatesecurity.cgiar.org>

ACKNOWLEDGEMENTS

This work is carried out with support from the Climate Action Science Program (CASP), and the CGIAR Food Frontiers and Security (FFS) Science Program. We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: [https:// www.cgiar.org/funders/](https://www.cgiar.org/funders/).

ABOUT US

CGIAR aims to address gaps in knowledge about climate change and food security for peace and security policies and operations through a unique multidisciplinary approach. Our main objective is to align evidence from the realms of climate, land, and food systems science with peacebuilding efforts already underway that address conflict through evidence-based environmental, political, and socio-economic solutions.

© 2026 CGIAR Climate Security. This is an open-access document distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. The views expressed in this document cannot be taken to reflect the official position of the CGIAR or its donor agencies. The designations employed and the presentation of material in this report do not imply the expression of any opinion on the part of CGIAR concerning the legal status of any country, territory, area, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The views expressed in this document cannot be taken to reflect the official position of the CGIAR or its donor agencies

SUDAN'S AGRI-FOOD SYSTEM: NATIONAL CHARACTERISTICS

Sudan's agri-food system is characterised by at least four distinct sub-sectors, namely, modern irrigated farming (carried out with on a large scale using subsidised mechanised equipment), mechanised rain-fed crop production, traditional rain-fed farming, and livestock raising/animal husbandry. Large-scale irrigation schemes along the White and Blue Niles, such as the Al Gezira Scheme located in Aj Jazirah state, produce the bulk of the country's commercial crops, including cotton, peanuts, sesame, gum Arabic, and sugarcane. Whilst Sudanese cotton production represents a small percentage of global production, its importance in the cotton market results from its ability to supply a large part of the extra-long-staple cotton grown in the world.

More widespread mechanised rain-fed farming systems are, by contrast, present in a broad belt stretching from the north-eastern to the south and south-west part of the country, practiced in the states of Kassala, Gadarif, Blue Nile, Sennar, White Nile, and South Kordofan.

Mechanised rain-fed farming systems are largely responsible for the production of Sudan's staple crops (with sorghum production accounting for 80% of cultivated land), accounting for around 45% of the country's annual requirement. One of the major challenges associated with this type of production, however, is the fact that richer farmers practice a version of traditional shifting cultivation, farming a particular area intensively for a short period of time before moving onto more attractive arable lands once yields decline. This practice has contributed to soil erosion and desertification in some previously arable areas.

Finally, traditional rain-fed agriculture is practiced predominantly at the household level, employing the greatest share of the population. Whilst widespread across the country, such production systems are predominantly found in the west of Sudan, particularly in Darfur and Kordofan. Subsistence crops such as sorghum and millet are most commonly grown in such production systems, although commercial crops such as groundnut and sesame are also grown on a small scale.

Overall, agriculture remains Sudan's most important economic sector, contributing to nearly one-third of national GDP whilst providing direct employment to about 54% of the country's total labour force and serving as a source of livelihoods for over 80% of Sudan's total population (ADRA, 2025).

The sector is moreover particularly vulnerable to projected climate change impacts, with Sudan's climate determined by the combined effects of the Intertropical Convergence Zone (ITCZ) as well as the country's diverse topographical features, including the coastline of the Red Sea, the inland catchment and plains of the Nile River, Savanna woodlands to the south, and extensive semi-desert and desert in the central and northern interior (AfDB, 2018). This diverse and varied geography means Sudan is exposed to a broad array of hydrometeorological and geophysical hazards (ICRC Climate Centre, 2022).

Sudan's cities are expected to experience a slight rise in temperature of between 0.06 and 0.08 °C/decade under RCP2.6, but a steep rise in temperature between 1 to 2 °C/decade for near future scenarios and 4 to 5 °C /decade in far future scenarios under RCP8.5. Rainfall is expected to shift to the north under RCP2.6 with a decrease in 1 mm/day in the southern part of the desert, while under RCP8.5 it shows a decline of the same magnitude over both Sudan and South Sudan.

These climate change phenomena are expected to lead to frequent and severe droughts and heatwaves, increasing the likelihood of wildfires, and significantly affecting ecosystem integrity, agricultural production, and public health (Mohamed et al., 2024). Similar phenomena are likely to be observed with regards to more frequent and intense heavy precipitation events, contributing to increased flood risk and soil erosion.

Credit: EU/ECHO/ Ludovico Gammarelli



OVERVIEW OF EASTERN SUDANESE AGRI-FOOD SYSTEMS

Gedaref state

Gedaref state is one of Sudan's south-eastern states, covering an approximate 75,250 square kilometres and bordering Kassala and Khartoum states to the north, Aj-Jazirah to the west, Sennar to the south, as well as sharing an international border with Eritrea and Ethiopia to the east and south-east. Gedaref's main soil type is known as *versitols*, a clay-rich soil generally considered chemically fertile but with relatively poor capacity to absorb water (Smiles and Raats, 2005). The state's climate is semi-tropical, characterised by hot and rainy summers – with the rainy season usually occurring between June/July and August/September – which deliver an annual average rainfall of between 700 and 900 mm (UNICEF, 2022).

The state is moreover considered part of Sudan's 'breadbasket', containing 6% of arable land in Sudan. Virtually entirely reliant upon rainfed forms of agriculture, about 70% of all mechanised farming in Sudan is carried out in Gedaref state and two-thirds of the state's workforce are active in the sector, with the majority of arable land being used to produce sorghum, millet, beans, as well as cash crops such as sesame, groundnuts, sunflowers, Arabic gum, and some citrus fruits. Combined with Aj-Jazirah state, Gedaref in fact contributes to an estimated 50% of Sudanese sorghum production (Mercy Corps, 2024; UNICEF, 2022). As of 2024, the state's 5-year average of estimated areas for cereal production include 2,348,990 hectares of semi-mechanised rainfed areas, whilst irrigation- and traditional rainfed-based production areas are negligible (FAO, 2025).

Despite this reliance upon cereal production, Gedaref state is also home to a number of more complex agricultural value chains. Groundnuts, sesame, as well as sunflower production all lend themselves to additional processing and value addition, such as through oil extraction, the creation of Tahina sweets (for sesame), and the production of peanut butter (ground nuts). Gedaref state currently houses two major sesame processing facilities, namely, Coben Investment Company (a government-owned enterprise) and Mahgoub Sons Group (a private enterprise), alongside a number of smaller-scale processing facilities for oil (ADRA, 2025).

Livestock and pastoralist production systems in Gedaref state tend to rely on cows, sheep, and camels, numbering an estimated 7.6 million heads of cattle (ADRA, 2025; UNICEF, 2022). As can be observed in other states, land-use changes have seen savannah-woodland – which acted as grazing lands for pastoralists and agro-pastoralists – transform into conventional croplands, leading to pastoralists groups being forced into rapid sedentarisation, urbanisation, and the erosion of traditional livelihood systems (Sulieman and Ahmed, 2013).

Kassala state

Kassala state borders Gedaref, Khartoum, River Nile, and Red Sea states and shares international borders with Eritrea and Ethiopia. Its landscape consists of 3 main soil types – badobe, clay, and mixed badobe-clay – and is characterised by green area cover for around half of the year, whilst in the remaining period, vegetation areas are commonly restricted to water courses, depressions, drainage channels, and water catchment areas (Gibreel and Gumaa, 2020). These local ecological trends are largely underpinned by Kassala's seasonal temperature and precipitation variability, which engender its generally arid and desert-like climate.

Credit: EC/ECHO/Anouk Delafortrie





Temperatures are generally lower during the fall and winter seasons but escalate significantly during the summer months (up to 46 degrees Celsius). Precipitation rates similarly peak during the rainy season in June/July and August/September – when Kassala receives approximately 40 mm and 81 mm of rain, respectively – but remain exceedingly low for the remainder of the year (NomadSeason, 2025).

Agricultural production in Kassala state relies on a combination of irrigated and rainfed agricultural production systems. As of 2024, the 5-year average of estimated cultivated areas across the state is as follows: 129,110 ha of irrigated land, 135,970 ha of traditional rainfed land, and 692,440 ha of semi-mechanised rainfed land (Mercy Corps, 2024). Kassala state contains several key agricultural schemes, including Seteet, Kahoat, El-Gash, and Halfa (UNDP, 2025). The latter 2 also form the state's main irrigation areas, namely, the Halfa Al-Jadeeda irrigation scheme – which largely produces sorghum, wheat, groundnut, sunflower, sugar, and cotton – and spate irrigation on the El-Gash River, producing both sorghum and horticultural crops (Mercy Corps, 2024). Cultivation areas around the El-Gash Delta, located in eastern Kassala, are situated within the Aroma/Wager flood retreat area, meaning that the timing of agricultural activities, labour demand, and household food security are often shaped by the annual flood cycle. The El-Gash River is generally dry from November to June, whilst during the rainy season, the El-Gash River's flows are highly variable and the risk of flash flooding increases (Shuka et al., 2024).

Farming for horticultural crops – such as fruits and vegetables – thrives particularly on the banks of the El-Gash Delta, having since the 19th century become a defining feature of Kassala (Abdullah, 2025). These include a variety of vegetables and fruits, including tomatoes, for which demand locally and regionally remains high and which possesses high processing potential for the production of value-added products such as paste, juice, or dried tomatoes (ADRA, 2025).

Livestock and pastoralist systems in Kassala state primarily centre around cows, sheep, and camels (ADRA, 2025). Rangelands in Kassala have been characterised by a variety of environmental challenges, including degradation as a consequence of overgrazing, the uncontrolled expansion of mechanised and traditional rainfed agricultural lands, and desertification (Mustafa, 2021).



White Nile state

White Nile state is located in the southeastern part of Sudan, occupying around 39,700 square kilometres. It borders Khartoum, Sennar, and Aj-Jazirah states in the northeast, South and North Kordofan states to its west, as well as sharing an international border with South Sudan to the south. The majority of the soil in cultivated areas in White Nile state consists of clay, with analysis indicating that the inherent fertility status of such soil is low due to low water retention capacity and being susceptible to wind erosion (Mohammed and Salih, 2022).

The impact of climate change on White Nile state has been severe, making it one of the fastest-warming areas in Sudan. Air temperatures have annually increased by an average of 1 degree Celsius, whilst precipitation rates and patterns have become less predictable (UNICEF, 2022). The state experiences 1 annual rainy season – starting in May/June and ending in August/September each year – however, evidence suggests that the variability of both average annual precipitation rates as well as the number of rainy days is increasing. This also corresponds to an increasing number of extreme precipitation events (often contributing to flooding), with White Nile state experiencing particularly frequent examples of such event in the south-eastern part of the state in 2019 and 2021 (Vagen and Musili, 2020).

The state is situated within Sudan's rainfed farming crescent, and as such relies primarily on mechanised and traditional, non-mechanised rainfed production systems. The majority of agricultural cultivation in White Nile state pertains to sorghum, wheat, and legumes, although cash crops such as cotton and sugar cane are also grown. The state's dependence on rainfed production, however – which relies on receiving on average more than 500mm of rain annually – means production is of a comparatively lower productivity than in irrigated systems (ADRA, 2025). As of 2024, the state's 5-year average of estimated areas for cereal production is as follows: 69,660 ha of irrigated land, 346,580 ha of semi-mechanised rainfed land, and 159,220 ha of traditional rain-fed lands (FAO, 2025).

Livestock and pastoralist systems in White Nile state consist mainly of cows, sheep, as well as fish. Riverine fish and aquaculture – despite having substantial potential to contribute to local production and food security – form some of the least developed sub-sectors of Sudan's agri-food system. Across White Nile, Blue Nile, and Sennar states, it is estimated that there are approximately 5300 fishers, mostly using primitive fishing techniques and without adequate infrastructure or sufficient regulation (ADRA, 2025).



Impact of conflict on agri-food production trends and dynamics

Despite the country's wealth of agricultural systems, Sudan has been battling a history of famine and food insecurity deeply anchored in the country's political economy reaching back to colonial times (Elkreem and Jaspars, 2024). The ongoing civil war in Sudan and clashes between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) have plunged wide parts of the country into unrest, displacing people, destroying infrastructure, and disrupting livelihoods, value chains, transportation pathways, and agricultural production processes. An intricate connection exists, moreover, between political and economic interests in the conduct of the conflict, with agri-food systems being instrumentalized for strategic warfare as military and paramilitary actors seek control of Sudan's agri-food system value chains. Economic dominance over food systems and other parts of the economy are used to finance military operations and are thus connected with political power. Strategies for military control of agri-food systems include market capture, monopolizing high revenue sectors, biased competition, selective investments, and withdrawal from technologically intensive private sector domains (IFPRI, 2025).

The large-scale displacement of people has led to additional major disruptions in Sudan's agricultural production sector. Since the beginning of the war in 2023, nearly 8.9 million people have been displaced within Sudan's borders, with the more peaceful and accessible Eastern parts of the country hosting large numbers of IDPs. Millions of Sudanese have additionally fled the country and sought safety neighbouring countries, notably Chad, Egypt, South Sudan, the Central African Republic and Ethiopia (UNHCR, 2025). In addition to this, the Sudan itself is already hosting a large refugee population, numbering an estimated 1 million even before the start of the newest conflict (UNHCR, 2025), placing further pressure on scarce resources and on the livelihoods of local communities.

The conflict had not only led to the destruction of property, agricultural production assets, and transportation infrastructure, but the abandonment of farms by rural communities facing insecurity also means that agricultural production in Sudan has been critically reduced, negatively impacting food security.

Sudden trade and market destabilisation, the inability of farmers to access and cultivate lands, the closing of manufacturing and processing facilities in urban centres affected by conflict (particularly Khartoum), as well as a breakdown in financial systems and connectivity, plunged 18 million people in Sudan into a situation of acute hunger during the 2023 harvest period, which saw an estimated 46% drop in agricultural production. The World Food Programme (WFP) was in turn only able to serve one in ten people affected during this period (WFP, 2023 and 2024, cited in Elkreem and Jaspars, 2024; Kirui et al., 2023).

Various analyses, therefore, support the notion that agricultural production has been severely hampered by the impacts of conflict, although such impacts are more apparent in some locales compared to others. A survey carried out by IFPRI with thousands of farmers across 16 states in Sudan revealed that 28% had been displaced by on-going conflict, 14% of which to outside their state of residence. Interviews revealed that the conflict had led to disruptions in the farming process, with 40% of interviewees not able or unwilling to prepare their land for the upcoming season.

Credit: EC/ECHO/Malini Morzaria





The study also revealed significant market impacts, reduced availability and price hikes in agricultural inputs such as seeds, fertilizers, and farm labour, making it impossible for a large portion of farmers to invest in production (Kirui et al., 2023). Sidahmed and Mohamed (2025) find clear evidence of a decline in cropping activities between December 2022 and December 2024 in Greater Khartoum, amount to a 22% reduction in total cultivated area. 36% of surveyed farmers reported not cultivating any crops in the 2023/24 winter season primarily due to conflict-related challenges, whilst less than a quarter of farmers now use improved seeds as a consequence of conflict-related input shortages (Sidahmed and Mohamed, 2025). In North Darfur, Akoy et al. (2025) similarly find evidence of reduced crop yields due to the combined impact of climate change and conflict, whilst CARE (2025) identify that 89% of surveyed farmers in East Darfur, South Darfur, and South Kordofan reported declines in productivity and 56% could not safely harvest their crops due to violence and insecurity.

There is also some evidence to suggest that the rate of agricultural production has decreased across several of the target geographies of this review. A UNDP assessment based on data collected in early 2024 recorded how across rural and peri-urban localities Kassala state, an average of 65% of respondents reported a considerable decline in land cultivation. Whilst in peri-urban areas the primary reason for this decline was attributed to broader economic instability, participants in rural areas indicated the lack of expected rains in 2023 as the most important barrier to cultivation. In Gedaref state, with data collection focused on Central Gedaref and Eastern Qalabat, an average of 62% of respondents reported a decreased in land cultivation. The most important drivers of this decrease include the broader effects of the 2023 crisis in Central Gedaref, whilst in Eastern Qalabat, high costs of agricultural inputs were most commonly cited as barriers to agricultural production (UNDP, 2025).

However, despite these challenges, some areas in eastern Sudan have nonetheless maintained acceptable crop yield rates, in part due to the efforts of international actors to provide emergency agricultural inputs in the face of market disruption. The 2024 rainy season, for instance, brought more cumulative rainfall than in the previous year and the long-term average, and demonstrated a good temporal distribution of precipitation. These conditions enabled an above-average area cultivated and a production level of cereals above the output obtained in 2023 (FAO, 2025).

REFUGEE AND IDP INTEGRATION INTO AGRI-FOOD SYSTEMS IN EASTERN SUDAN

The conflict in Sudan has engendered a massive displacement crisis. By June 2025, some 7.7 million Sudanese were internally displaced, 270,000 refugees and asylum seekers were secondarily displaced, and over 4 million had fled to neighbouring countries (UNHCR, 2025). Research from various geographic settings reveals that hosting displaced populations tends to place significant pressure on host communities. Maystadt et al. (2019), for instance, note that most displaced populations are located in the world's poorest countries, and argue that tensions may arise due to competition over environmental resources – such as water, arable land, or forest lands – as well as over economic resources and opportunities or socio-cultural differences. These tensions have a higher likelihood of occurring in circumstances characterised by political uncertainty or when available aid and support is unequally distributed (Ansar and Khald, 2021).

That said, over time and despite the often initial socio-economic shock, the presence of displaced communities may also elicit investments and engender new forms of solidarity and cooperation that benefit both displaced and host communities. Displaced populations may for instance stimulate local economies by increasing demand for goods, services, or providing injections into local labour markets (particularly in construction- and agriculture-related sectors), and can also create new opportunities for entrepreneurship and trade (Babiker and Aalen, 2024).

Findings from Sudan broadly reflect many of these same trends. Elhaj (2018, cited in Babiker and Aalen, 2024) records the immense pressure placed on local resources and public services due to large concentrations of IDP populations, whilst Babiker et al. (2021) highlight the disruptive socio-economic and cultural impacts of Ethiopian refugees arriving in eastern Sudan. Myriad examples also exist, however, of IDP and host communities finding innovative ways to work together to secure incomes and promote resilience, including in the agri-food sector.

Gedaref state

In Gedaref state, for instance – a major destination for internally displaced populations, with just over 402,000 displaced individuals remaining there as of August 2025 mostly from Khartoum – there is evidence of new forms of synergy between different agricultural actors, including IDPs.



Cooperation between large- and small-scale farmers and IDP communities primarily take the form of share-farming arrangements, land leasing, and collaborative work that connects available labour with underutilised land. For larger local farmers facing restricted access to credit, escalating input costs, and severe labour shortages, developing informal partnership mechanisms with IDP households are essential for maintaining agricultural operations and preventing land abandonment, particularly given the seasonal nature of the pre-war rural labour market (Sulieman, 2025). For small-scale local farmers, such arrangements offer a way to cope with rising food prices and living expenses, whilst for IDPs, they form opportunities to access land, generate earnings, and effectively integrate into host economies (Sulieman, 2025).

Particularly visible in central and southern Gedaref state, the nature of these informal agricultural arrangements differs depending on crop type. For sesame production, cooperation begins early in the planting season, with large-scale farmers typically preparing the land and carrying out the initial cultivation whilst small-scale farmers and IDPs take on labour-intensive tasks such as weeding and harvesting. For sorghum, cooperation is largely concentrated on the harvesting stage once the crop has matured. In return for their labour, the harvest is shared based on an agreed-upon split – usually 50/50 – although in some cases large-scale farmers take up to two-thirds when they provide additional services (Sulieman, 2025).

Despite the in some cases obvious benefits to parties involved in such agreements, the rules of engagement between different partners – and as such the nature of these partnerships – are often shaped by unequal power dynamics, land tenure uncertainty, and informal negotiations in which some are exposed to exploitation. Without coherent institutional support and regulation, these bottom-up cooperation models risk deepening existing inequalities or becoming temporary coping strategies rather than pathways to long-term recovery (Sulieman, 2025). It is similarly important to recognize that depending on the origin and extent to which IDP households have access to capital and relevant skills, not everyone is likely to be able to take advantage of such opportunities. Those originating from urban areas likely lack the skills to engage in agriculture effectively, and thus require training to become more productive (Wahlstedt and Sulieman, N.D.).

Kassala state

Kassala state remains home to just under 80,000 IDPs as of August 2025, mostly from Khartoum. The state has also seen the highest number of returning individuals and households in recent months as the situation in and around Khartoum has somewhat stabilised, witnessing an 18% decrease in its IDP population since July 2025 (IOM, 2025). The majority of IDPs households are concentrated in urban areas, particularly in Kassala and Halfa Al-Jadeeda towns, where services are available and prior social connections are more likely. The influx of IDPs across the state since 2023 has placed considerable strain on Kassala's already underserved infrastructure, with specific challenges emerging around water, fuel, electricity, and healthcare (ACAPS, 2024).

Kassala state is also home to several refugee camps pre-dating the onset of the 2023 conflict, including Shagarab I, II, and III; El Girba; Kilo 26; Abuda; and Wad Sharife. By the end of 2024, Sudan as a whole continued to host around 860,000 refugees and asylum seekers – mainly from South Sudan, Eritrea, Ethiopia, Syria, and the Central African Republic – a 13% decline since the onset of the conflict due to secondary displacement and cross-border movements. As of October 2025, 111,000 of these are located in Kassala state, the majority settled in dedicated camps and constructed settlements (UNHCR, 2025).

There is some evidence to suggest that a number of IDPs – particularly those with financial means – have taken up farming in the irrigation basins along the El-Gash River, an agricultural scheme to which Wad Sharife refugee camp lies in close proximity. Displaced farmers are recorded to have brought with them diverse agricultural knowledge and techniques, introducing new agricultural methods (such as seed varieties, fertilizers, pesticides, and greenhouses) and irrigation techniques whilst growing crops previously absent from the region's markets and food culture, such as zucchini, parsley, and cabbage (Abdullah, 2025). These dynamics have led to increased outputs in shorter time-frames, and contributed a greater degree of vegetable self-sufficiency in Kassala. The diffusion of these improved farming techniques have moreover also influenced broader agricultural market dynamics, leading to broader value chain development as agricultural supply stores across El-Gash River's western markets and Halfa Al-Jadeeda record increased sales of seeds, fertilizers, solar energy systems, and greenhouse services. Lastly, displaced agri-food business actors – such as those previously active in processing or agricultural input production – have also began investing in such agro-industry in Kassala state, which is now home to several fertilizer production sites (Abdullah, 2025).



It remains unclear how the influx of internally displaced farmers into the El-Gash River area has impacted the ability of refugees also inhabiting the area to access means of agricultural production. Previous research indicates that whilst refugees do not own land, they too are in practice able to rent land from host communities, predominantly through either renting land at a flat fee (after which all produce goes to refugees during the harvest season) or to rent the land at no cost, but with around a fifth of produce going to the landowner during the harvest season (UNHCR, 2023). It is uncertain how recent internal displacement trends have affected such arrangements.

White Nile state

As of October 2025, White Nile state is home to just under 460,000 IDPs, being amongst the most common destinations for displaced individuals outside of the Darfur states themselves, where the majority of active conflict is occurring. The state also hosts the highest number of refugees and asylum seekers in Sudan, numbering some 610,000 individuals (of which just under 210,000 are secondary displacements) mostly spread across 10 existing refugee camps in the state (UNHCR, 2025). There, moreover, a growing risk of further displacement occurring as the incidence of conflict in White Nile state increases, particularly in some northern areas. Whilst there is something of a dearth of evidence with regards to clearly documented cases of IDP households becoming integrated into local agricultural production systems in White Nile state – as well as the mechanisms through which this occurs – some previous and ongoing programming efforts by international support providers nonetheless indicate that cooperation between host and displaced communities is nonetheless occurring in the context of the agri-food sector.

The International Labour Organisation's (ILO) PROSPECTS programme, for example, targets a comprehensive package of support to both displaced and host community female farmers in White Nile state. This package includes the transmission of sustainable agricultural practices to boost yields, the establishment of several cooperatives that enable the aggregation of produce and provide extension support, the development of market linkages with local trader associations, and the creation of a remote-sensing support component (ILO, 2025). Comparable initiatives include(d) the Adventist Development and Relief Agency's (ADRA) Sustainability Agrifood Systems Approach for Sudan (SASAS) programme, active in both Blue Nile and White Nile states (ADRA, 2024), and WFP's Sudan Emergency Wheat Production Project (SEWPP), supported by AfDB (AfDB, 2025).

GOVERNANCE SYSTEMS AND APPROACHES TO AGRICULTURAL PRODUCTION IN EASTERN SUDAN

Pre-war agri-food sector governance

Despite the historical and contemporary importance of agriculture in Sudan, the sector has performed comparatively poorly in terms of its contribution to GDP and real GDP growth during the past 2 decades, even prior to the onset of conflict in 2023. On average, during the 1990s, the sector's share of value added GDP was 43%, which dropped to 32% during the 200s and as low as 28% during the 2010s (Alhelo et al., 2023). Nonetheless, the sector played an essential role in the country's domestic food security by supplying the bulk of cereals and oilseeds, with locally produced wheat accounting for an approximate 15% of Sudan's total domestic wheat consumption prior to the conflict. In the context of broader international turmoil in 2021-2022 (particularly the Russo-Ukraine war), the government of Sudan undertook a series of short-term stabilization measures for the sector to protect domestic food markets, including the continuation of wheat subsidies, trade restrictions in the form of export bans, government wheat purchases in order to build strategic cereal reserves, as well as importing wheat from other sources (Alhelo et al., 2023).

Credit: EC/ECHO/Anouk Delafortrie





Moreover, particularly following the secession of South Sudan in 2011 and the corresponding economic losses this entailed as oil production capacities were lost, the government of Sudan attempted the development of a series of longer-term measures to promote reform within the agricultural sector and leverage its potential for growth. A succession of national development programs and plans were as such prepared in which the sector featured heavily, including the Five-Year Economic Reform Program (2015-2019) – which set a series of quantitative crop production targets for key cereals such as sorghum, wheat, and millet – as well as the Sudanese National Agricultural Investment Plan (SUDNAIP) (2016-2020), which similarly includes production and productivity objectives, seeks to promote an enabling environment for sustainable agricultural development, develop agro-industrial and value chains, and engage in sustainable natural resource management. These efforts were characterised by only limited implementation, with the majority of sectoral investment commitments not being realised (Alhelo et al., 2023; Osman et al., 2022).

In the immediate pre-coup period, the government additionally announced a Three-Year Economic Stability and Development Programme (2021-2023) as well as the Sudan Poverty Reduction Strategy Paper (PRSP) (2021-2023). Whilst the former continued to draw attention to many of the aforementioned sectoral strategic priorities, the PRSP was created to enable Sudan to meet the criteria of the Heavily Indebted Poor Countries Initiative, outlining a series of economic reforms – including the development of the agricultural sector – to enable Sudan to qualify for debt relief and arrears clearance from the international financial community. Both of these initiatives were cut short by the October 2021 military coup (Alhelo et al., 2023).

In a political economic sense, the October 2021 military coup largely enabled the continuation of the rentier political economic arrangements that characterised governance of the agricultural sector under Al-Bashir's 30-year dictatorship. Following Sudan's popular revolution in 2019, the transitional government inherited a complex and loosely defined economic governance structure characterised by the prevalence of State-Owned Enterprises (SOEs), private company partnerships, and land lease mechanisms dominated by military and paramilitary actors. Cross-sectoral estimates as to the total number of such SOEs were found to be in excess of 650, of which around 200 were under the purview of the Military Economic Corporation (MEC) or the Special Fund for the Social Security of the Armed Forces (SFSSAF) at time of writing in 2022 (Cartier et al., 2022).



Tellingly, one of the key factors that immediately precipitated the 2021 military coup was a strategic review of such military and paramilitary owned enterprises alongside the suggestion to integrate such ownerships structures under the Ministry of Finance and Economic Planning (MFEP), thus threatening the economic powerbase of these actors (D'Silva et al., 2023).

SOEs often benefit from bespoke regulatory advantages and forms of government support not generally extended to private sector companies, including subsidies, tax breaks, in-kind advantages, or access to favourable financing terms and guarantees (Hansen et al., 2022). Both the SAF and RSF engage in different agri-food value chains using distinct strategies based on the technical complexity of value addition and the level of private sector involvement (Resnick et al., 2025). The impacts of these political economic arrangements and the considerations external actors should make when seeking to strengthen agri-food resilience in various sub-sectors of the agri-food sector is, as such, varied.

Livestock

Sudan's livestock sub-sector – which has a notably large export component in that it accounts for 12% of total GDP and 33% of all agri-food related GDP – is largely dominated by SOEs, mostly under the purview of the SAF-owned Multiple Directions Company but with elements of different value chains also controlled by the RSF. The export of livestock to countries such as Saudi Arabia, Egypt, Qatar, and others is moreover highly lucrative, with exports of live sheep to Saudi Arabia alone having been estimated at 400\$ annually (Humphrey et al., 2021). The involvement of SOEs into the livestock export market – as well as other export activities, such as those related to cash crops – has led to a disruption of these commodity markets and lowered returns for smallholders producers (Abushama et al., 2023).

Urgent investments are required to further develop livestock-related value chains in Sudan, with higher returns potentially realisable by improving infrastructure, developing traceability systems and quarantine practices, investing in slaughterhouses and cold chain infrastructure, and disseminating technical knowledge (World Bank, 2020). Small-scale producer access to market information is currently moreover very limited, leaving primary producers at the mercy of traders, preventing the accumulation of capital, and discouraging producers from investing in intensification of productivity improvements (D'Silva et al., 2023).



However, due to the ability of both armed actors to generate high rents under the status quo and the absence of other major private sector actors in this sectoral space, there is little incentive for military and paramilitary actors to invest in substantial value addition that might help expand Sudan's access to international markets or meet growing domestic demand (Resnick et al., 2025).

Agriculture

The RSF and SAF are both to some extent embedded within agricultural production, processing, and export dynamics across Sudan in ways that disadvantage smallholder farmers and producers, stifle innovation and value chain development, and disincentivise private investment. Depending on the nature of the sub-sector – particularly in relation to the extent of private sector involvement and import/export potential – agri-food enterprises affiliated with armed actors adopt different strategies to continue to enable conflict-supporting capital accumulating patterns.

Authorities in Sudan have long marginalised smallholders in favour of (foreign) large-scale agricultural enterprises, contributing to land grabbing and large land leases to foreign entities and states (Muhammad and Purba, 2024). In practice, these dynamics are closely intertwined with SAF business interests. For instance, Zadna – the largest agricultural SOE and closely affiliated with the SAF – owns land plots in many states, is heavily involved in pivot irrigation and agricultural schemes, and operates in the sales and leases of agricultural land for private investment. Enabled by tax exemptions, rapid mobility of produce, and preferential export facilitation, large-scale SAF-affiliated agri-businesses are able to outcompete other private actors in Sudan's agricultural market (Abushama et al., 2023).



This phenomenon is particularly apparent in Sudan's horticultural sub-sector, within which the country's private sector is much less active and where space for SAF-affiliated enterprises to grow is notable. The aforementioned Zadna has played an active role in developing Sudan's horticultural value chain, predominantly through its emphasis on large-scale agricultural and irrigation schemes – often based on opaque land annexations – that have enabled it to generate an estimated \$1.5 billion in annual revenues (Resnick et al., 2025).



Zadna has also invested in various value chain-supporting industries, possessing a large nursery for preparing high-quality seedlings for citrus, banana, and mango; labs for tissue culture; and engaging in research on new seedling varieties, fruit and vegetable drying, and waste management. Such investments are not motivated by broader value chain development objectives, however, but rather the generation of revenue for the SAF (Resnick et al., 2025).

In other sub-sectors where private actors have been able to develop a more permanent presence, military and paramilitary actors are forced to adopt different strategies. For instance, in the case of wheat milling (a processing sub-sector), this entails engaging in active competition with private sector actors whilst unfairly benefitting from a distorted enabling environment. In general, this creates a policy landscape decisively skewed towards enterprises affiliated with the SAF, whom are in turn able to outcompete private sector actors through structural power as opposed to market-driven efficiencies (Resnick et al., 2025).

Wheat is a major food commodity in Sudan, however, domestic production rates only account for around 15% of the country's total consumption demands, meaning that dependency on wheat imports is notably high (an estimated \$1 billion in 2022 alone) (Abdelazis et al., 2022). Given this well-entrenched domestic demand and the earning potential associated with its associated import market, the wheat flour sub-sector forms an attractive rent-seeking opportunity for SAF-affiliated enterprises (most notably a company known as Seen). Competition with private sector actors in this agri-food space, most notably the DAL conglomerate, is enabled through a series of preferential treatments in the form of price distortions, selective import licensing, foreign exchange rationing, and subsidies (Resnick et al., 2025).

ROLE OF HUMANITARIAN-DEVELOPMENT ACTORS

International actors have since the onset of the 2023 conflict – often in partnership with local government authorities, non-governmental organisations, and agri-food sector entities – engaged in a variety of sectoral support initiatives across the three target states. A typology of these interventions is outlined below:

- Emergency seed distribution and planting support: primary led by FAO but also other partners such as World Vision International, NUHA Foundation, ZOA, and Mercy Corps, large-scale drought-resistant seed distribution activities have taken place in Gedaref, Kassala, and White Nile states since 2023. Disbursements of sorghum, millet, legumes, and vegetable seeds are completed in line with Sudan's seasonal and agriculture cycle, thereby enabling the cultivation of crops for domestic consumption as well as to bring to market (thereby improving the availability of basic foodstuffs for wider populations. For the 2025-2026 season, seed distribution has been undertaken in partnership with the Sudanese Ministry of Agriculture and Forestry, with state-level agricultural directorates overseeing and coordinating deliveries (SudanHorizon, 2025).

Credit: UNDP Sudan





Such efforts are often accompanied by on-the-job training for recipients on seed characteristics, the agricultural calendar, optimal sowing periods and techniques, integrated pest management, and appropriate fertilizer application (FAO, 2025).

Non-profit actors typically engage with Sudanese companies to purchase seeds locally and then distribute at no cost to recipients. Approaching disbursement in this way, however, carries a higher risk of inappropriate use when compared to reselling at a minimal affordable price. Additionally, due to the collapse of centralised agricultural input markets and extension services, promoting decentralised agricultural services at community or village level is recommended (Hoffman et al., 2024).

- Livestock support and veterinary and fodder assistance: again, led primarily by FAO, international actors have offered support to small-scale pastoralists or animal agriculturalists in the form of animal restocking. Assistance is also provided to the government of Sudan to intensify vaccination efforts for sheep, goats, and cattle, particularly against Peste des petits ruminants (PPR), sheep and goat pox, foot-and-mouth disease, Rift Valley fever, black quarter, contagious bovine pleuropneumonia, and haemorrhagic septicaemia (FAO, 2023; FAO, 2025).
- In-kind food assistance and cash-based transfer programmes: WFP and its partners on the ground have developed general food assistance (GFA) support programmes primarily in, on the one hand, food rations and cash-based transfers (CBTs) that enable vulnerable populations to meet immediate food and nutritional needs, and emergency nutrition support aimed at addressing malnutrition on the other. In 2024, WFP assisted around 6.1 million people with general food assistance and around 1.7 million through CBTs, consisting of more than 800,000 refugees as well as 3.4 million IDPs. WFP additionally invests in a variety of longer-term resilience activities, such as social protection, climate adaptation, and smallholder farmer support, with more than 328,000 smallholders benefiting from training, agricultural inputs, and post-harvest loss management in 2024 (WFP, 2024).

- **Refugee- and IDP-focused legal, livelihood, and host community support:** international actors such as UNHCR and IOM have developed several programmatic interventions to offer tailored support to Sudan's refugee and IDP populations. With regards to refugees, UNHCR continues to offer biometric registration and reception services, undertake refugee status determination (RSD) activities, and engage in a variety of protection-related activities to ensure eligibility for the receipt of humanitarian aid and promote access to essential services and asylum procedures (UNHCR, 2024).

UNHCR's livelihood and economic inclusion efforts, based on the 'solutions from the start' approach, have included the promotion of climate smart agriculture, business entrepreneurship, and financial inclusion to promote social cohesion between different groups. In 2024, over 13,600 households received training in business entrepreneurship, livestock production, and financial literacy, whilst 1500 households were provided with climate smart agricultural, livestock, and fisheries interventions. Village savings and loan associations were moreover set up for 425 households to strengthen financial inclusion and access to microcredit facilities (UNHCR, 2024). Furthermore, in partnership with FAO, UNHCR developed ways to integrate refugees into agricultural projects to address disruptions in food production within local food systems. By working with state-level governmental units and the private sector – particularly local agri-food sector actors that offered access to land and provided technical agricultural training – UNHCR-supplied inputs have enabled refugees to become more integrated into rural production systems and associated economies (UNHCR, 2024).

IOM has similarly sought to identify and promote opportunities for building inclusive community resilience in Sudan, shifting from humanitarian aid to economic self-reliance and the creation of revenue-generating systems. Intervention modalities utilised for the promotion of early economic recovery include the provision of cash grants and technical assistance to CBOs, displaced persons, and host communities to establish new business ventures; deliver market-oriented vocational training and inclusive skills developing programmes; distribute in-kind income generating assets, based on community-identified priorities and locally appropriate value chains; facilitate capacity building of communities and authorities on climate-smart and drought-resistant agricultural and livestock management techniques, and develop Cash-for-Work (CfW) programmes (IOM, 2025).



Under its Community Stabilisation and Community-driven Development pillar, IOM moreover continues to mitigate the exposure of displaced populations to increased communal tensions of scarce resources or services in destination areas. This includes the revitalisation of critical infrastructure in areas experiencing an influx of new arrivals, promoting understanding between host and displaced communities through dialogue mechanisms and the establishment of community committees, and supporting reconciliation and non-violent political processes to manage local conflicts (IOM, 2025). In Gedaref state, for example, IOM's climate security programmes have utilised its community-based planning methodology to mitigate the confluence of climate vulnerabilities and conflict drivers, bringing communities together to collaboratively identify key risks and drivers of conflict affecting their communities (IOM, 2024).

- **Climate and disaster risk insurance and anticipatory action:** humanitarian and development partners – primarily WFP – have developed partnerships with the African Risk Capacity (ARC) Replica to aid emergency preparedness and mitigate the destabilisation associated with natural shocks through Climate and Disaster Risk Financing and Insurance (CDRFI). CDRFI approaches rely on pre-arranged financing and insurance mechanisms triggered by pre-identified risk parameters that enable more rapid payouts in the event of an emergency to minimise crisis impacts. In 2024, WFP purchased a \$1 million drought insurance policy covering just under 112,000 people and worth just over \$4.5 million, which due to favourable rainfall, did not trigger (WFP, 2024). The role of CDRFI programming has increased in importance in recent years, particularly as Sudan's pre-war social protection infrastructure – most notably, the Zakat or the National Pension and Social Insurance Fund (NPSIF) – has become instrumentalised by Sudan's clientelist state to the extent that it can no longer be considered as serving a developmental purpose (Mahgoub et al., 2025).

ROLE OF LOCAL AND STATE AUTHORITIES

Sudan's pre-war governance of the agri-food sector mirrored the country's broader federal institutional arrangements, with the central Ministry of Agriculture and Forests forming the core national institution responsible for overall agricultural policy and strategy, regulation and oversight, and coordination. In practice, however, Sudan's 18 states exercises significant levels of autonomy over legislation, budget execution, development programming, and service delivery, with each state possessing its own Ministry of Agriculture and Forests. State ministries were usually responsible for activities such as extension services, input supply, infrastructure maintenance, and agricultural facilities related to crops, small-scale irrigation, livestock, and fisheries in their respective state (FAO, 2015).

Sudan's federal Ministry often maintained a supervisory mandate pertaining to national-level agricultural investments and major irrigation schemes – such as the Gezira Scheme, Rahad Agricultural Project, Suki Agricultural Project, and Halfa al Jadidah irrigation project – as well as providing the institutional link for international and regional cooperation around agri-food sector development and natural resource management (MoAF, N.D.).

Credit: Việt Anh Nguyễn/Pexels





Pre-war governance of the Sudanese agri-food sector was, however, subject to numerous institutional weaknesses and shortcomings. These included capacity challenges in budget formulation and allocation, staffing, a general lack of strategic prioritisation of rainfed agriculture, and variation in the transfer and disbursement of federal funds. There is also often a lack of clarity around various departmental mandates and their boundaries – which varied across states – as well as a lack of clarity around the division of statutory powers between state and federal levels. Mechanisms for harmonising policies and targets across states were absent, and policymaking was often limited to a top-down process in which sectoral stakeholders – such as small-holder farmers – were often marginalised (FAO, 2015).

State and local level agricultural institutions have however, as previously mentioned, suffered severe disruption as a consequence of the 2023 conflict. Conventional ministerial capacities and mandates such as research, input supply, veterinary services, and infrastructure maintenance have collapsed amongst widespread insecurity. In Gezira Scheme alone, for instance, an estimated 1470 breaches in irrigation canals have been detected, whilst state-run warehouses storing seeds, fertilisers, and other inputs as well as extension infrastructure such as seed banks have been looted or burnt by conflict actors (Hoffman et al., 2024). Repeated targeting of state-run power plants have also contributed to widespread power outages, meaning electric-powered irrigation systems have become dysfunctional and many farms left without water (CEO, 2025).

Whereas prior to the conflict international actors therefore primarily served to support governmental systems, the current role of international actors is primarily to act as a stopgap for currently eroded state and local agricultural governance capacities. Key agri-food actors such as WFP and FAO run parallel delivery systems for seeds, tools, and livestock support by procuring and distributing certified seeds, supplying small-scale irrigation infrastructure, and assisting in recovery activities such as re-establishing community seed reserves and engaging in infrastructure rehabilitation. In many cases, international actors have also replaced state ministries' data collection and management capacities for food security monitoring processes, such as seasonal assessments, crop yield measurements, market monitoring, and pest surveillance. Such tasks are undertaken through expanded remote-sensing, key informant networks, and use of humanitarian data.

ENABLING ENVIRONMENT FOR AGRICULTURAL PRODUCTION

An enabling environment for agricultural production exists when policies, infrastructure, finance, technology, markets, institutions, and natural resources function together to support productivity and sustainability. This section assesses how these elements operate in Sudan.

Policy and Institutional Framework: Sudan's national strategies recognize agriculture as a priority sector. However, policy implementation is weak due to political instability, conflict, and frequent institutional changes. Inconsistent subsidies, unclear land tenure arrangements, and limited enforcement reduce investor and farmer confidence. As a result, agricultural planning is fragmented, and long-term investment is discouraged.

Infrastructure: Agricultural infrastructure in Sudan is largely inadequate and deteriorating. Major irrigation schemes, notably the Gezira Scheme, suffer from poor maintenance and management. Rural roads, storage facilities, electricity, and water supply are insufficient, especially in conflict-affected areas. These constraints raise production costs and cause significant post-harvest losses.

Access to Finance: Access to affordable agricultural finance is extremely limited. Formal banking services are weak, and institutions such as the Agricultural Bank of Sudan operate below capacity. Credit, insurance, and savings products tailored to farmers are scarce, forcing many producers to rely on informal financing. This limits the use of improved inputs and mechanization.

Technology, Inputs, and Extension Services: The adoption of modern agricultural technologies in Sudan is low. Farmers face high costs and limited availability of quality seeds, fertilizers, and machinery. Agricultural research and extension services are under-resourced and have limited outreach, leaving most farmers dependent on traditional production methods and vulnerable to climate shocks.

Markets and Value Chains: Market access is constrained by poor transport infrastructure, insecurity, and price volatility. While Sudan has potential in both domestic and export markets, weak value chains, limited agro-processing, and high transaction costs reduce farm profitability. Market information systems are also poorly developed.



Institutions and Social Organization: Agricultural institutions, cooperatives, and farmer organizations are generally weak. Limited coordination among public institutions and between public and private actors reduces service delivery effectiveness. Women and youth, despite playing key roles in agriculture, face additional barriers in access to land, finance, and training.

Natural Resources and Climate Factors: Sudan possesses vast arable land, diverse agro-ecological zones, and significant water resources from the Nile system. However, climate change, droughts, floods, desertification, and soil degradation increasingly threaten agricultural productivity. Weak natural resource management further exacerbates these challenges.

Despite strong natural resource endowments, Sudan's enabling environment for agricultural production is weak and fragile. Conflict, economic instability, poor infrastructure, limited finance, weak institutions, and climate risks prevent the effective integration of key enabling factors.

ROLE OF PRIVATE SECTOR COMPANIES / VALUE CHAINS

There are several large agricultural production companies operating in Eastern Sudan who have a large network of smallholder contract farmers. In terms of the presence and functioning of input and output markets in Eastern Sudan (**Kassala, Gedaref, and Red Sea states**), evidence suggests that they present, active, and largely driven by private sector actors. These markets underpin the region's agricultural production systems and enable the flow of staple crops, oilseeds, and livestock to domestic and export markets. While functioning under challenging conditions, they remain central to livelihoods, food security, and regional trade.

Input markets are most developed in Gedaref State, where private agro-dealers supply seeds, fertilizers, agro-chemicals, fuel, and machinery services to mechanized and smallholder farmers. Access to inputs is often mediated through informal, seasonal credit arrangements with traders. Although this sustains production in the absence of formal finance, it increases farmer dependency and vulnerability to price shocks. Input availability and quality decline in more remote areas, particularly in Kassala and Red Sea states.



Output markets are dynamic and well integrated into national and cross-border trade systems. Private traders and aggregators dominate crop purchasing, transport, storage, and marketing. Gedaref serves as a major grain and oilseed hub, while Kassala and Port Sudan facilitate domestic distribution and export flows, especially for sesame and livestock. However, limited storage capacity and weak market information systems force many farmers to sell immediately after harvest at unfavorable prices.

From a **market systems and resilience perspective**, these markets demonstrate adaptive capacity but remain fragile. Infrastructure gaps, climate variability, limited finance, and power imbalances between farmers and traders constrain efficiency, inclusiveness, and shock absorption. Strengthening market functionality is therefore critical to enhancing resilience, reducing vulnerability, and supporting sustainable livelihoods in Eastern Sudan.

With regards to relevant financial, transport, energy, and ICT infrastructure, agricultural performance and resilience in Eastern Sudan are strongly shaped by the availability and quality of financial, transport, energy, and ICT infrastructure. These systems underpin production, market access, value addition, and farmers' capacity to cope with climate and economic shocks. While basic infrastructure exists, it remains uneven, urban-centered, and insufficient to support inclusive and resilient agricultural growth.

Financial infrastructure is limited in rural areas, restricting access to credit for smallholder farmers, pastoralists, and agri-SMEs. As a result, informal finance—particularly trader- and input-supplier credit—dominates. Although this sustains seasonal production, it reinforces power imbalances, constrains farmer choice, and increases vulnerability to price and climate shocks.

Transport infrastructure connects Eastern Sudan to national and export markets, particularly through Gedaref and Port Sudan. However, poor and seasonal feeder roads significantly increase transport costs, limit market access during the rainy season, and contribute to post-harvest losses. These constraints reduce farm-gate prices and discourage private investment in remote agricultural areas.

Energy infrastructure is uneven and unreliable, especially outside major towns. Limited access to affordable electricity constrains irrigation, agro-processing, storage, and cold-chain development, resulting in low levels of value addition and continued dependence on raw commodity sales.

ICT infrastructure, particularly mobile connectivity, is relatively widespread and offers growing potential for market coordination, financial inclusion, and climate risk management. However, limited internet access, low digital literacy, and weak digital service ecosystems restrict its impact.

Overall, gaps in these interconnected infrastructures increase transaction costs, limit productivity and value addition, and weaken the resilience of agricultural systems. Strengthening them—especially in rural and production-intensive areas—is critical to improving food security, livelihoods, and shock resilience in Eastern Sudan.

Credit: UNHCR/Samuel Otieno



BIBLIOGRAPHY

Abdelrahman Osman et al. (2022) Sudan's challenges and opportunities: A renaissance project for Sudan - From poor agriculture to agro-industrial growth and sustainable development. Policy Brief 99. Economic Research Forum. Available at: <https://erf.org.eg/publications/sudans-challenges-and-opportunities-a-renaissance-project-for-sudan-2/?tab=undefined&c=undefined>.

ACAPS (2024) Sudan: Impact of long-term displacement in the East. Briefing note. ACAPS, pp. 1–7. Available at: [https://www.acaps.org/fileadmin/Data_Product/Main_media/20240308 ACAPS Sudan Impact of long-term displacement in the East.pdf](https://www.acaps.org/fileadmin/Data_Product/Main_media/20240308_ACAPS_Sudan_Impact_of_long-term_displacement_in_the_East.pdf).

Adam Babiker et al. (2021) Eastern Sudan: Hosting Ethiopian refugees under tough conditions. 2. Bergen: Chr. Michelsen Institute (CMI). Available at: <https://www.cmi.no/publications/7943-eastern-sudan-hosting-ethiopian-refugees-under-tough-conditions>.

Adam Babiker and Lovise Aalen (no date) When refuge is home: Sudan's war-affected IDPs in Gedarif state, Eastern Sudan. 2. Bergen: Chr. Michelsen Institute (CMI). Available at: <https://www.cmi.no/publications/9444-when-refuge-is-home-sudans-war-affected-idps-in-gedarif-state-eastern-sudan>.

ADRA (2024) 'Replanting hope in Sudan through sustainable agriculture'. Available at: <https://adra.org/replanting-hope-in-sudan-through-sustainable-agriculture>.

ADRA (2025) Value chain assessment in Sudan. Adventist Development and Relief Agency (ADRA). Available at: <https://fscluster.org/sites/default/files/documents/ADRA%20Sudan%20Value%20Chain%20Presentation.-%20FSL%20cluster-ATWG%20Meeting%20-%2011Aug.2025.pdf>.

AfDB (2018) National Climate Change Profile: Sudan. Country profile. African Development Bank. Available at: https://www.afdb.org/sites/default/files/documents/publications/afdb_south_sudan_final_2018_english.pdf.

AfDB (2025) 'Farmers cultivate wheat and hope to avert a food crisis in Sudan'. Available at: <https://www.afdb.org/en/success-stories/farmers-cultivate-wheat-and-hope-avert-food-crisis-sudan-87898>.



Alzaki Alhelo, Khalid Siddig, and Oliver Kirui (2023) The architecture of the Sudanese agricultural sector and its contribution to the economy between 1990 and 2021. IFPRI Discussion Paper 02191. IFPRI. Available at: <https://cgspace.cgiar.org/server/api/core/bitstreams/66a0e94d-27b6-4fdc-9f91-87d0bd20183a/content>.

Anette Hoffman, Mutaz Mohamed, and Laurens van den Tempel (2024) Sudan's agricultural input supply in times of war: Proposed interventions to counter the unfolding famine. CRU Report. Clingendael. Available at: https://www.clingendael.org/sites/default/files/2025-01/Sudans_agricultural_input_supply_war_final.pdf.

Ansar, A. and Md. Khaled, A.F. (2021) 'From solidarity to resistance: host communities' evolving response to the Rohingya refugees in Bangladesh', Journal of International Humanitarian Action, 6(1), p. 16. Available at: <https://doi.org/10.1186/s41018-021-00104-9>.

Anwar Sidahmed and Shima Mohamed (2025) Impact of armed conflict on crop production in Greater Khartoum, Sudan. 23. IFPRI. Available at: <https://cgspace.cgiar.org/server/api/core/bitstreams/44dce31a-9576-4b51-a01b-cc41abc83762/content>.

Bashir Abdullah (2025) 'Blessings in disguise as displaced farmers' turn around agriculture fortunes in Kassala', Atar: Sudan in perspective. Available at: <https://atarnetwork.com/wp-content/uploads/2025/02/ATAR-English-Issue-22.pdf>.

Brian D'Silva et al. (2023) Political constraints and opportunities for agricultural investment in Sudan. Policy Note 4. IFPRI. Available at: <https://cgspace.cgiar.org/server/api/core/bitstreams/4a303add-6690-468b-8456-438b397694fb/content>.

CARE (2025) Conflict, agriculture, and women. Research brief. CARE. Available at: <https://reliefweb.int/attachments/0afa62cb-d32e-44d8-b55e-f97e8a7ca653/Conflict%2C%20agriculture%20and%20women%20in%20Sudan%20-%20FINAL.pdf>.

Catherine Cartier, Eva Kahan, and Isaac Zukin (2022) Breaking the bank: How military control of the economy obstructs democracy in Sudan. C4ADS. Available at: <https://c4ads.org/wp-content/uploads/2022/07/BreakingtheBank-Report.pdf>.



CEO (2025) The environmental costs of the war in Sudan. Conflict and Environment Observatory. Available at: https://ceobs.org/the-environmental-costs-of-the-war-in-sudan/?utm_source=chatgpt.com

Danielle Resnick et al. (2025) Under the gun: Military and paramilitary actors in Sudan's agri-food system. IFPRI Discussion Paper 02328. IFPRI. Available at: <https://cgspace.cgiar.org/server/api/core/bitstreams/5784a49f-8087-4c78-a59b-f9b889fdd831/content>.

Eero Wahlstedt and Hussein Sulieman (no date) Supporting conflict-resilient food systems in Sudan. The Conflict Sensitivity Facility. Available at: <https://csf-sudan.org/wp-content/uploads/2024/08/csf-research-supporting-conflict-resilient-food-systems-in-sudan.pdf>.

Elamin Akoy et al. (2025) Climate change, conflicts, and food security in North Darfur state, Sudan: Risks and implications. 4. Bergen: Chr. Michelsen Institute (CMI). Available at: [https://www.cmi.no/publications/9623-climate-change-conflicts-and-food-security-in-north-darfur-state-sudan-risks-and-implications#:~:text=It%20is%20estimated%20that%206.6,availability%20\(FAO%2C%202023\).](https://www.cmi.no/publications/9623-climate-change-conflicts-and-food-security-in-north-darfur-state-sudan-risks-and-implications#:~:text=It%20is%20estimated%20that%206.6,availability%20(FAO%2C%202023).)

Elkreem, T.A. and Jaspars, S. (2024). Sudan's catastrophe: the role of changing dynamics of food and power in the Gezira agricultural scheme. *Disasters*, 49:e12663. <https://doi.org/10.1111/disa.12663>

Elniema Abdelkhalig Mustafa (2021) Assessment of vulnerability of livestock and rangelands to climate change impacts in Sudan. FAO. Available at: <https://napreadiness.hcenr.gov.sd/wp-content/uploads/2025/07/NAP-Readiness-Project-Impacts-of-non-climatic-drivers-on-the-vulnerability-of-livestock-in-Sudan.pdf>.

Elnour Alamin Gibreel and Abdel Gabar Nasir Gumaa (2020) 'Ecological study of the diversity of the woody plant species of El-Gash area in Kassala state', *Kassala University Journal* [Preprint], (16). Available at: <https://kassalauni.edu.sd/nw/kassalaojs/wp-content/uploads/sites/2/2022/03/16-5.pdf>.



FAO (2015) Country programming framework for Sudan - Plan of Action (2015-2019): Resilient livelihoods for sustainable agriculture, food security, and nutrition. Country programming framework. FAO. Available at: https://faolex.fao.org/docs/pdf/sud201507.pdf?utm_source=chatgpt.com.

FAO (2023) The Sudan Emergency Livelihood Response Plan, September 2023 – August 2024. FAO. Available at: <https://doi.org/10.4060/cc7644en>.
FAO (2025a) Special Report: 2024 FAO Crop and Food Supply Assessment Mission (CFSAM) to the Republic of the Sudan. FAO. Available at: <https://doi.org/10.4060/cd4973en>.

FAO (2025b) Sudan; Emergency seed distribution to vulnerable farming households in White Nile state. Project Highlights. FAO. Available at: <https://reliefweb.int/attachments/9ab07ca3-9cce-5713-967c-d7d61d1cf953/cd6722en.pdf>.

Hala Abushama et al. (2023) Political and economic drivers of Sudan's armed conflict: Implications for the agri-food system. Working Paper 15. IFPRI. Available at: <https://cgspace.cgiar.org/server/api/core/bitstreams/9675f4f3-7309-4a18-b9a9-4e19ee3f9152/content>.

Hussein Sulieman (2025) 'Farming against the odds: How local synergies are sustaining agriculture amid conflict and displacement in Eastern Sudan', Sudan-Norway Academic Cooperation (SNAC). Available at: <https://www.cmi.no/publications/9762-farming-against-the-odds>.

ICRC Climate Centre (2022) Sudan: Climate factsheet. Country-level fact sheet. ICRC. Available at: <https://www.climatecentre.org/wp-content/uploads/RCCC-Country-profiles-Sudan-2022-Final-1.pdf>.

IFPRI (2025). IFPRI – Sudan: Generating Evidence-Based Solutions for Strengthening Humanitarian Response and Economic Resilience. Sudan Strategy Support Program, 2025.

ILO (2025) 'Empowered with ILO's training, women farmers in Sudan expand cooperative and market opportunities'. Available at: <https://www.ilo.org/resource/article/empowered-ilo%E2%80%99s-training-women-farmers-sudan-expand-cooperative-and-market>.

IOM (2025a) 2025 crisis response plan: Sudan and neighbouring countries. IOM. Available at: [https://crisisresponse.iom.int/sites/g/files/tmzbd11481/files/appeal/pdf/custom/IOM%202025%20Crisis%20Response%20Plan Sudan%20and%20neighbouring%20countries%202.pdf](https://crisisresponse.iom.int/sites/g/files/tmzbd11481/files/appeal/pdf/custom/IOM%202025%20Crisis%20Response%20Plan%20Sudan%20and%20neighbouring%20countries%202.pdf).

IOM (2025b) Sudan Mobility Update: August Monthly Update. 21. IOM Displacement Tracking Matrix (DTM). Available at: <https://dtm.iom.int/sites/g/files/tmzbd11461/files/reports/DTM%20Sudan%20Mobility%20Update%20%2821%29.pdf?iframe=true>.

IOM (no date) *Sudan and neighbouring countries: End of year report 2024*. IOM. Available at: <https://www.iom.int/sites/g/files/tmzbd12616/files/2025-06/iom-sudan-and-neighbouring-countries-2024-report.pdf>.

Jean-Francois Maystadt *et al.* (2019) 'Impacts of hosting forced migrants in poor countries', *Annual Review of Resource Economics*, 11(1), pp. 439–459. Available at: <https://econpapers.repec.org/scripts/redir.pf?u=https%3A%2F%2Fdoi.org%2F10.1146%2Fannurev-resource-090518-095629;h=repec:anr:reseco:v:11:y:2019:p:439-459>.

Kirui, O., Siddig, K., Ahmed, M., Abushama, H. & Taffesse, A.S. (2023). *Impact of the Ongoing Conflict on Smallholder Farmers in Sudan Evidence from a Nationwide Survey*. IFPRI Strategy Support Program Working Paper 17.

Kjetil Hansen *et al.* (2022) *State-owned enterprises annual report (Prototype) 2021*. 169258. Washington D.C.: World Bank Group. Available at: <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/099400103082230263/p1754710c2fdaa07094e40427ee33953eb>.

Lena Mahgoub, Omer Egemi, and Calum McLean (2025) *Charting a course for social protection in Sudan: Bridging research and policy*. Conference Report. United Kingdom: STAAR. Available at: https://csf-sudan.org/wp-content/uploads/2025/08/final_b286_sudan-sp-conference-report_final_.pdf.

Mercy Corps (2024a) Remote sensing to anticipate agriculture conditions: Gedaref state. Sudan Crisis Analysis. Mercy Corps. Available at: <https://www.mercycorps.org/sites/default/files/2024-03/sudan-gedaref-remote-sensing-march-2024.pdf>.

Mercy Corps (2024b) *Remote sensing to anticipate agriculture conditions: Kassala state*. Sudan Crisis Analysis. Mercy Corps. Available at: <https://www.mercycorps.org/sites/default/files/2024-03/sudan-kassala-remote-sensing-march-2024.pdf>.

MoAF (no date) 'About us'. Available at: https://moaf.gov.sd/about.html?utm_source=chatgpt.com.

Mohamed, A.A.A., Maharana, P., Phartyal, S.S & Dimri, A.P. (2024). Projected change in precipitation and temperature over undivided Sudan and its major cities, *Meteorology and Atmospheric Physics*, 136:1. <https://doi.org/10.1007/s00703-024-01017-z>.

Muhammad, A.S.A. and Purba, A.M. (2024) 'The Government-Farmer Conflict in Sudan: A Deepening Crisis in Agriculture', *Journal of Peasants' Rights*, 3(2), pp. 107–114. Available at: <https://doi.org/10.32734/jpr.v3i2.19262>.

NomadSeason (2025) 'Kassala climate', *NomadSeason*. Available at: <https://nomadseason.com/climate/sudan/kassala.html>.

Nuha Ahmed Mohammed and Ahmed Ali Salih (2022) *Degradation of the vegetation cover in the White Nile state*. Seoul: Forestry and Gum Arabic Research Centre. Available at: <https://openknowledge.fao.org/server/api/core/bitstreams/f9dfbb9b-01d5-4aef-a6f7-b1b197f1c533/content>.

Shuka, K.A.M. *et al.* (2024) 'Impact of Structural and Non-Structural Measures on the Risk of Flash Floods in Arid and Semi-Arid Regions: A Case Study of the Gash River, Kassala, Eastern Sudan', *Sustainability*, 16(5), p. 1752. Available at: <https://doi.org/10.3390/su16051752>.

SudanHorizon (2025) 'In partnership with FAO, Agriculture Ministry launches seed distribution for small farmers', *SudanHorizon*. Available at: <https://sudanhorizon.com/in-partnership-with-fao-agriculture-ministry-launches-seed-distribution-for-small-farmers/>.

Sulieman, H.M. and Ahmed, A.G.M. (2013) 'Monitoring changes in pastoral resources in eastern Sudan: A synthesis of remote sensing and local knowledge', *Pastoralism: Research, Policy and Practice*, 3(1), p. 22. Available at: <https://doi.org/10.1186/2041-7136-3-22>.



Tor-G Vagen and Faith Musili (2020) *Identifying and mapping areas that are particularly vulnerable to changes in climate: White Nile and North Kordofan states, Sudan*. Progress report. ICRAF. Available at: https://www.ctc-n.org/system/files/dossier/3b/report_SudanClimateVulnerability_Output2.pdf.

UNDP (2025) *Adverse impacts of the triple crisis on food insecurity and livelihoods in Sudan*. Assessment. i-APS. Available at: https://www.undp.org/sites/g/files/zskgke326/files/2025-06/final_undp_triple_crisis_report-i-aps_june_2025.pdf.

UNHCR (2023) *Sudan Livelihoods Roadmap (2023-2025)*. UNHCR. Available at: <https://data.unhcr.org/en/documents/download/93788>.

UNHCR (2024) *Annual results report: Sudan (2024)*. UNHCR. Available at: <https://www.unhcr.org/sites/default/files/2025-06/Sudan%20ARR%202024.pdf>.

UNHCR (2025). *Sudan Emergency*. <https://www.unrefugees.org/emergencies/sudan/>
UNHCR (2025) 'Operational Data Portal'. Available at: <https://data.unhcr.org/en/country/sdn>.

UNICEF (2022a) *State profile: Gedarif*. State profile. UNICEF. Available at: <https://www.unicef.org/sudan/media/8651/file/Gedarif.pdf>.

UNICEF (2022b) *State profile: White Nile*. State profile. UNICEF. Available at: <https://www.unicef.org/sudan/media/8751/file/State%20Profile-%20White%20Nile.pdf>.

WFP (2023). WFP warns that hunger catastrophe looms in conflict-hit Sudan without urgent food assistance. Website. 13 December. <https://www.wfp.org/news/wfp-warns-hunger-catastrophe-looms-conflict-hit-sudan-without-urgent-food-assistance> (last accessed on 19 September 2024).

WFP (2024). WFP demands urgent access to aid hungry millions amid Sudan conflict'. Mirage News website. 2 February. <https://www.miragenews.com/wfp-demands-urgent-access-to-aid-hungry-1166675/> (last accessed on 19 September 2024).



WFP (2024a) *Optimizing early action and risk financing opportunities: Evidence from WFP's participation in the ARC Replica Initiative*. WFP. Available at: https://docs.wfp.org/api/documents/WFP-0000157511/download/?_ga=2.200525354.560942358.1765291930-1000301926.1765190044.

WFP (2024b) *Sudan: Annual country report 2024*. WFP. Available at: https://docs.wfp.org/api/documents/WFP-0000165435/download/?_ga=2.49099247.853559077.1765190044-1000301926.1765190044.

World Bank (2020) *Sudan: Agriculture value chain analysis*. 150438. Washington D.C.: World Bank Group. Available at: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/731741593616746051/sudan-agriculture-value-chain-analysis>.