

### CRISIS OVERVIEW

Sudan is anticipating severe humanitarian challenges during the 2024 rainy season, influenced by conflict and environmental factors. The seasonal forecast predicts above-average rainfall and higher-than-average temperatures across southern and central states, with potential La Niña conditions enhancing the rainy season from August–September. These conditions are expected to increase risks of riverine and flash flooding, particularly affecting agricultural lands and water resources by September (WB accessed 09/04/2024; FAO 20/03/2024; ICPAC accessed 28/05/2024).

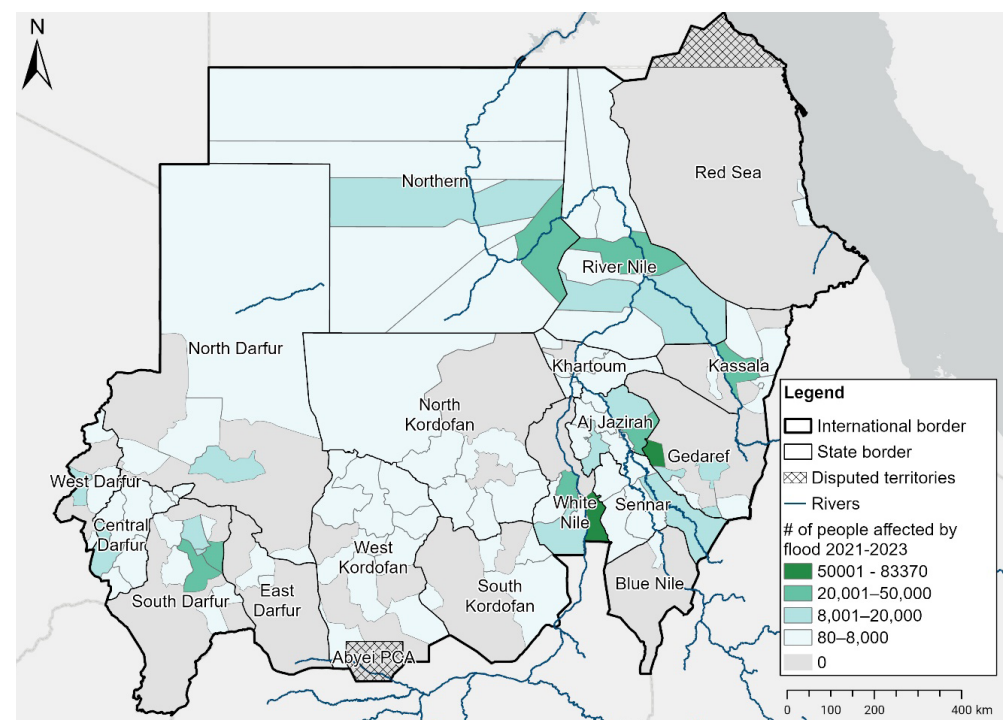
Heavy rainfall and floods pose a threat to agriculture – which supports 65% of Sudan’s population – potentially destroying land and infrastructure and worsening food insecurity for around 18 million people (ICRC 05/10/2022; FAO 20/03/2024). Stagnant water and health infrastructure damage from increased rainfall also raise the risk of vector-borne and waterborne diseases (Hussien 11/10/2020; SSHAP 19/04/2023). Flooding in 2024 could also damage schools and disrupt education for many children (OCHA 25/09/2022; UNICEF 22/12/2022).

The 2024 rainy season is anticipated to severely hamper humanitarian access and response capacity, as was the case in previous years. In 2022, floodwaters temporarily isolated regions and damaged infrastructure, hindering the transport of commercial and humanitarian goods. Critical shortages in relief supplies and logistical challenges further impeded the humanitarian response (OCHA 23/08/2022 and 25/09/2022; KII 24/04/2024). Access issues may be particularly severe in White Nile state, home to over 578,000 IDPs (UNHCR accessed 19/06/2024; MSF 01/10/2023). Humanitarian response to the rainy season and floods in Sudan has mostly been reactive. Funding constraints hinder anticipatory actions, forcing the prioritisation of the most affected populations.

### Methodology

This report is based on an analysis of approximately 80 publicly available sources, including documents produced by international organisations, UN agencies, local and international media, and research institutes. Sources selected provided information that could inform the analysis of the 2024 rainy season’s anticipated impact, including past and present contextual information. A key informant interview was also conducted with a national response specialist to fill some of the information gaps identified during the secondary data review.

Map 1. Number of flood-affected people between January 2021 and December 2023



Source: ACAPS using data from OCHA (21/02/2024)

### Limitations

- State-specific information on previous flood response efforts was unavailable, with only fragmented data accessible.
- Access constraints impede primary data collection in conflict-affected regions, limiting the understanding of current humanitarian needs in these areas. This is reflected in the scope of available secondary data.
- Information on the response and lessons learnt from the 2023 rainy season were scarce.
- Other information gaps included information on the potential impact of flooding on IDP households and information on specific protection risks likely to worsen during the rainy season.

## BACKGROUND

Over the years, Sudan has witnessed a troubling escalation in drought frequency, a trend expected to worsen as temperatures rise. If current low rainfall patterns persist, the Sahara will continue encroaching southwards at a rate of 1.5km annually, consuming agricultural and grazing lands (UNEP 13/02/2023). Historical records reveal severe drought episodes in 1967–1973 and 1980–1984, with successive years of drought from 1985–1993 worsening food shortages, displacement, and health crises, particularly in western Sudan (UN-WATER accessed 20/04/2024; NCCD/UNCCD 21/11/2018). These droughts varied in intensity across Sudan’s diverse ecological zones, lasting several years in localised regions and directly affecting natural resources and livelihoods (NCCD/UNCCD 21/11/2018).

Conversely, Sudan is also vulnerable to seasonal floods – both flash floods and riverine flooding – during the rainy season. Flash floods (rapid and intense inundation of low-lying areas) often occur within minutes to hours of heavy rainfall, aggravated by deforestation and land degradation (NWS accessed 18/04/2024; Mahmood et al. 09/06/2017; MECGA 04/04/2024). Riverine flooding results from prolonged and intense rainfall exceeding river capacity, leading to overflow and the widespread inundation of areas not typically submerged (Govt. QLD accessed 18/04/2024). Floods not only cause the loss of lives and property but also disrupt agricultural livelihoods, damage infrastructure, and increase the risk of disease outbreaks (GFDRR et al. 31/05/2021). The worst floods experienced in Sudan in the last century occurred in 2020 and affected over 900,000 people (OCHA 29/09/2021).

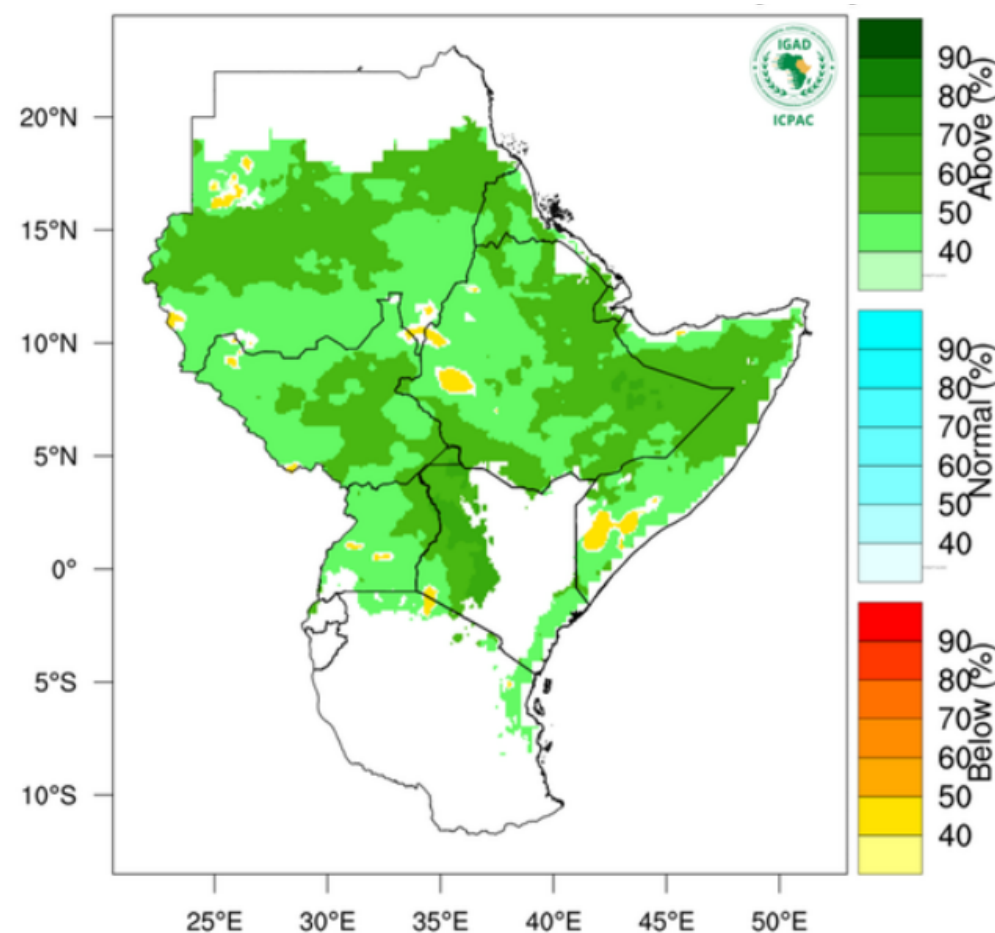
Flooding of the Blue Nile, heightened by heavy Ethiopian rainfall, poses significant riverine flood risk, while southern regions face flash floods from seasonal rivers occurring from mountain rainfall. In 2022, floods affected around 349,000 people, extensively destroying houses and infrastructure across 16 states, with fatalities and injuries reported. 2023 numbers, despite the decrease (with only approximately 90,000 flood-affected people), indicate recurring vulnerability, with conflict worsening the situation (OCHA 25/09/2022 and 05/11/2023).

Conflicts, economic challenges, and population growth compound Sudan’s climate vulnerability, raising the risk of an imminent water crisis (TWP accessed 18/05/2024). Climate change aggravates this situation, with rising temperatures accelerating water evaporation, decreasing soil moisture levels, and further compromising agricultural viability (WHO 12/10/2023; UNEP accessed 17/04/2024). The conflict, notably between the Sudanese Armed Forces (SAF) and Rapid Support Forces (RSF), has displaced over 9.3 million people since 15 April adding strain to Sudan’s already fragile resources.

## Seasonal precipitation and temperature forecast

Rainfall patterns in Sudan are inconsistent and unpredictable, significantly differing across the country. In the north, rainfall is minimal, averaging less than 50mm annually, while central regions receive between 200–700mm per year. Certain southern regions receive substantially more, exceeding 1,500mm annually. Most of the rainfall occurs during the rainy season (June–October), with peak levels typically between June–September (WB accessed 09/04/2024; FEWS NET accessed 09/04/2024).

Map 2. Rainfall probabilistic forecast, May–July 2024



Source: ICPAC (accessed 28/05/2024)

The Intergovernmental Authority on Development Climate Prediction and Applications Centre has forecast an above-average start of the rainy season in June and July 2024 in southern and central states (ICPAC accessed 28/05/2024). Above-average precipitation is expected to continue until September, and temperatures will likely remain above average in large parts of the country during the same period (C3S accessed 24/04/2024; IRI accessed 24/04/2024; WMO accessed 24/04/2024). Above-average precipitation may increase the risk of riverine and flash flooding in flood-prone areas. Seasonal forecasts also anticipate above-average June–September precipitation in South Sudan and the region around Lake Tana in Ethiopia, increasing the risk of riverine flooding in the downstream areas of White Nile and Blue Nile in Sudan. Despite the anticipated above-average June–September rains, some regions may still observe localised dry spells because of the country’s increasing rainfall variability and unpredictability together with high seasonal temperatures.

El Niño typically suppresses the rainy season in Sudan, delaying the onset of rains, delivering below-average rainfall, and causing intermittent dry spells. Conversely, La Niña enhances the rainy season, bringing above-average precipitation (Palmer et al. 21/03/2023; ACAPS 17/10/2016; FAO 23/12/2020). Based on recent forecasts, El Niño-Southern Oscillation (ENSO) conditions are expected to return to neutral by the end of June, and La Niña is likely to develop by the end of September (NOAA 17/06/2024). This means that the 2024 rainy season in Sudan may start under ENSO-neutral conditions and then evolve under La Niña, with above-average precipitation towards the end of the season (August–September 2024).

Like ENSO, the Indian Ocean Dipole (IOD) influences precipitation and temperature patterns in East Africa. Positive IOD is linked with wetter, shorter rains over the region. During such phases, precipitation can be two to three times the long-term average (Palem et al. 21/03/2023). Current IOD model forecasts anticipate that it may become positive between June–August, which could enhance Sudan’s rainy season (BOM accessed 28/05/2024).

## ANTICIPATED HUMANITARIAN IMPACTS OF THE 2024 RAINY SEASON

### Increased food security and livelihood needs

The convergence of conflict and the rainy season compounds the already dire humanitarian situation in Sudan in relation to food security and livelihood access. Expectations of an above-average rainy season, coupled with events from previous rainy seasons, suggest that heavy rainfall and floods will likely destroy large areas of agricultural land and boreholes (ICRC 05/10/2022). Agriculture remains the primary income source for approximately 65% of the population involved in the sector (FAO 20/03/2024). Poor spatial distribution of rainfall could also lead to pockets of localised drought, causing high levels of humanitarian need among affected populations, particularly concerning food security.

Outbreaks of Rift Valley fever (RVF) also typically occur during the transmission period, which in Sudan usually aligns with the rainy and flooding season (CEPI accessed 24/04/2024). The lack of robust health surveillance systems for both human and animal populations means there is no dependable assessment of RVF mortality and abortion rates among livestock. RVF outbreaks and epidemics have killed both human and animal populations, accounting for 98% of reported livestock deaths or abortions (Ahmed et al. 10/11/2020). Outbreaks within animal populations will further disrupt livelihoods, as livestock is the largest subsector of Sudan’s domestic economy by value (UNEP accessed 12/04/2024).

Following approximately one year of internal conflict, approximately 18 million individuals in Sudan are facing acute food insecurity, marking the highest figure documented during a harvest period. The conflict has significantly aggravated the situation, leading to limitations in agricultural output, substantial damage to crucial infrastructure and livelihoods, trade disruptions, and notable price hikes (FAO 20/03/2024). As the conflict intensifies, access to food supplies may become even more challenging during this year’s rainy season. The possible destruction of agricultural land and boreholes by heavy rainfall and floods will worsen the already dire food security situation (ICRC 05/10/2022). Given the currently high levels of acute food insecurity, there is also a risk that localised droughts could cause severe starvation among affected populations.

### Health

The upcoming rainy season with above-average rainfall is expected to have significant implications for the health sector, as seen in previous years, with rises in vector-borne diseases, including chikungunya, malaria, and dengue fever, when stagnant water serves as a breeding ground for mosquitoes. Above-average rainfall and flooding, combined with

above-average temperatures, may also lead to increased incidences of cholera, malaria, and dengue, among other diseases (Hussien 11/10/2020). In 2019, for instance, there were 1,197 dengue fever cases – including five deaths – recorded in Gedaref, Kassala, North Kordofan, Red Sea, and North, South, and West Darfur states. During 2022, a total of 15 states, including 74 localities, experienced different emergencies, such as heavy rains and floods, the malaria incidence going above the epidemic threshold, chikungunya outbreaks, and high numbers of dengue cases. The latter, in particular, affected 11 states containing 70 localities, with 5,212 cases by December (Radio Dabanga 08/11/2019; WHO 09/02/2023). Floods, which are expected in the upcoming rainy season, worsen the situation by increasing the risk of water contamination and waterborne disease outbreaks. Infrastructure damage, such as collapsed boreholes and broken pipes, further elevates these risks, as observed in previous rainy seasons (OCHA 22/10/2020; VOA 25/09/2023).

Conflict aggravates the health crisis during the rainy season, as damaged infrastructure and disrupted healthcare services worsen disease transmission and water contamination (SSHAP 19/04/2023). The armed conflict in Sudan has inflicted near-catastrophic impacts on the water supply, with rockets, bombs, and other explosive weapons damaging critical infrastructure, such as water treatment plants. This poses a grave challenge, with water and sanitation systems under threat, putting millions at risk (VOA 25/09/2023; IFMSA 25/03/2024).

Malaria incident rates vary across regions, in part affected by the duration of the rainy season, which extends from approximately three months (July–September) in the northern regions to six months (June–November) in Blue Nile, South Darfur, and South Kordofan states (Health Cluster 03/04/2024).

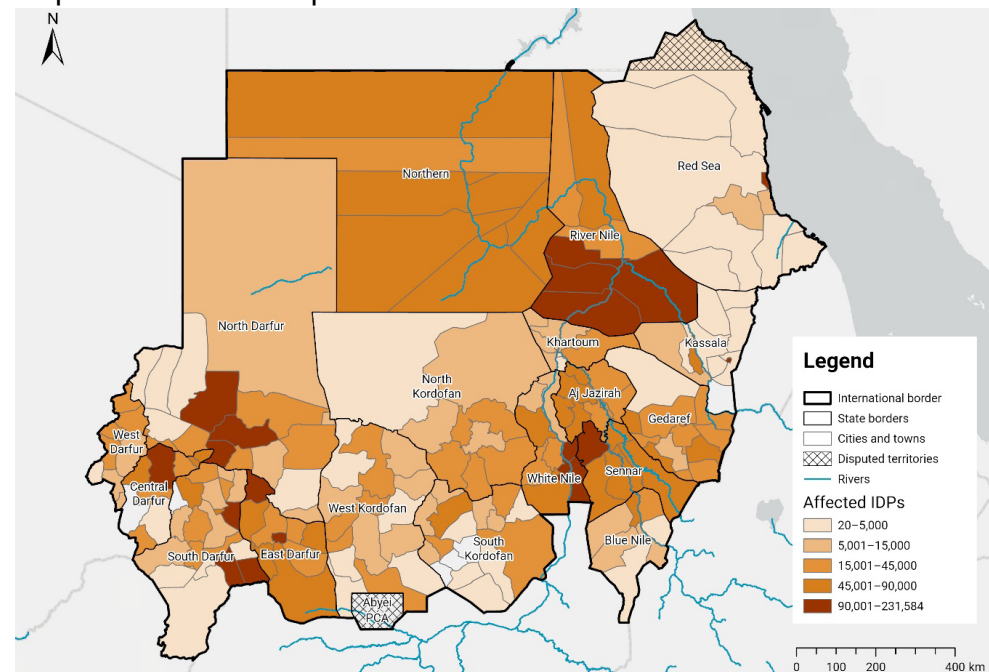
## Education

The risk of flooding, associated with the upcoming rainy season, increases the risk of impeded education access for children. In 2022, floods damaged nearly 400 schools, affecting the education of approximately 140,000 children. School infrastructure damage significantly delayed the start of the 2022–2023 academic year, with nine states rescheduling from 18 September to mid-October or later (OCHA 25/09/2022; UNICEF 22/12/2022). Without proper education preparedness measures for this year's rainy season, schools are likely to face heavy impacts, with flooding leaving more children out of school and further delaying academic progress. Flooding is also likely to limit schools' capacities to enrol children. This could lead to more dropouts, leaving children at risk of reduced psychosocial wellbeing as well as child labour and exploitation in a country already grappling with millions of out-of-school children (UNICEF 17/08/2021).

## Displacement

The anticipated rainy season and expected flooding are likely to increase the humanitarian needs of displaced people, particularly those living in informal settlements or temporary shelters, which floods have historically damaged severely (UNHCR 30/03/2023). Sudan has been experiencing internal displacement since the Darfur conflict in 2003 (UNHCR 22/09/2023). By 9 June 2024, there were approximately 9,222,000 displaced people (UNHCR accessed 14/06/2024). Consequently, Sudan has the largest IDP population globally (UNHCR 14/04/2024). By 15 April, an estimated 6% of IDPs were living in gathering sites, including informal settlements or open areas, another 6% in formal camps, and 1% in improvised or critical shelters (IOM 15/04/2024). IDPs and refugees living in informal settlements, improvised and temporary shelters, and schools face a high risk of further displacement, as heavy rains tend to destroy temporary shelters. The insecurity and lack of shelter leave them vulnerable to harsh weather and increase their risk of having unmet food and NFI needs. Overcrowded areas, such as informal settlements and temporary shelters, are also vulnerable to waterborne diseases resulting from the combination of heavy rains and insufficient WASH facilities (UNHCR accessed 18/04/2024; UNCHR 30/03/2024; OHCHR 05/02/2024).

Map 3. Locations of displacement



Source: ACAPS using data from IOM (accessed 07/05/2024)



## Increased inter-communal conflict

The rainy season has also been linked to intercommunal conflict. Competition over limited resources, worsened by the migration of nomadic populations, has led to episodes of violence (UNSC 24/01/2022). In 2021, intercommunal conflict incidents notably rose throughout Sudan, especially in Darfur, coinciding with the onset of the rainy season and cultivation period in July and August. These escalated conflict incidents led to heightened displacement, the loss of lives and livelihood assets, and disruptions to the agricultural season (FEWS NET 01/09/2021).

## Reduced humanitarian access and response capacity

The upcoming rainy season and likely flooding may increase the risk of reduced humanitarian access because of logistical challenges, such as inaccessible transportation routes. During the 2022 rainy season, in Aj Jazirah, Blue Nile, Central Darfur, and White Nile states, floodwaters and resulting road infrastructure damage temporarily hindered the transportation of both commercial and humanitarian goods. A response capacity mapping conducted in June identified a significant deficiency in relief items and critical shortages of supplies, preventing responders from prepositioning resources before the flood season. The Food Security and Livelihood, Shelter and NFI, Nutrition, Health, and WASH Clusters all reported substantial deficits in supplies nationwide, impeding service delivery (OCHA 23/08/2022).

If access challenges plague Aj Jazirah as they did in the 2022 season, then these will likely cut off White Nile state – which has one of the highest IDP numbers (over 570,000) and the most people facing unmet needs – from humanitarian access (KII 24/04/2024; IOM 29/05/2024; MSF 01/10/2023). White Nile state is situated along the White Nile River, making it vulnerable to substantial riverine flooding that could affect access during the rainy season (USAID/iMMAP 22/11/2023). These constraints will also impede access to protection services at a time of heightened risk (KII 24/04/2024).

The 2024 rainy season is expected to result in multiple road closures as the rains render them inaccessible. The season will likely worsen cross-border access, particularly from South Sudan. Roads connecting South Sudan to southwestern Sudan, including Nyala and Ed-Daein, often face access difficulties during the rainy season (Logistics Cluster 06/06/2023). The At Tina border crossing into North Darfur is also expected to present aid delivery challenges, particularly during the rainy season, because of distance and poor road conditions (FEWS NET 20/03/2024).

Among the displaced population, humanitarian needs already exceed the capabilities of the humanitarian response, particularly in densely populated informal settlements, camps, and other IDP resettlement areas, resulting in a dire humanitarian situation. Access challenges

have hampered humanitarian groups' distribution of vital supplies, leading to widespread hunger and malnutrition among those affected and worsening the protection crisis (UNHCR 14/04/2024).

Access issues linked to the rainy season compound responders' existing humanitarian access challenges, including difficulties in obtaining visas and travel permits for staff and lengthy and bureaucratic clearance processes for humanitarian supplies (MSF 18/01/2024 and 08/04/2024; OCHA 08/12/2022; OCHA 15/05/2024). In government-controlled areas, responders have faced obstructed access to areas outside SAF control, with cases of looting, carjacking, and the arrest and harassment of medical workers witnessed in RSF-controlled areas (MSF 12/04/2024).

The humanitarian response to Sudan's rainy season and floods has mostly been reactive. In 2022, following the depletion of funds, the Sudan Humanitarian Fund relied exclusively on its rapid response funding targeting the most affected states (OCHA 08/12/2022). The Sudanese Ministry of Health has an emergency plan for each rainy season, but the response is slow and aid delivery usually delayed. Some of the challenges that the response has faced include a lack of regular assessments and the inconsistency of staff availability (KII 24/04/2024). Conflict has disrupted preparedness efforts in Sudan, including the Sudanese Red Crescent's 2021–2024 forecast-based financing project aimed at mitigating humanitarian hazards, with forecasting work happening remotely until June 2023 (Anticipation Hub accessed 18/05/2024).

## Logistical and political obstacles to aid delivery

The lack of blanket travel permits and other stringent access constraints also inhibit timely aid delivery to flood-affected populations (OCHA 08/12/2022). For an unspecified amount of time, travel permits have not been granted, notably in Khartoum. The process to acquire visas for humanitarian staff to get into Sudan has also been long and difficult, coupled with challenges in acquiring permits to move around Sudan (MSF 18/01/2024 and 08/04/2024). Humanitarian supplies also await clearance for multiple weeks (OCHA 15/05/2024). As mentioned above, access from government-controlled areas to those outside SAF control has been deliberately obstructed, with cases of looting, carjacking, and the arrest and harassment of medical workers witnessed in RSF-controlled areas (MSF 12/04/2024).