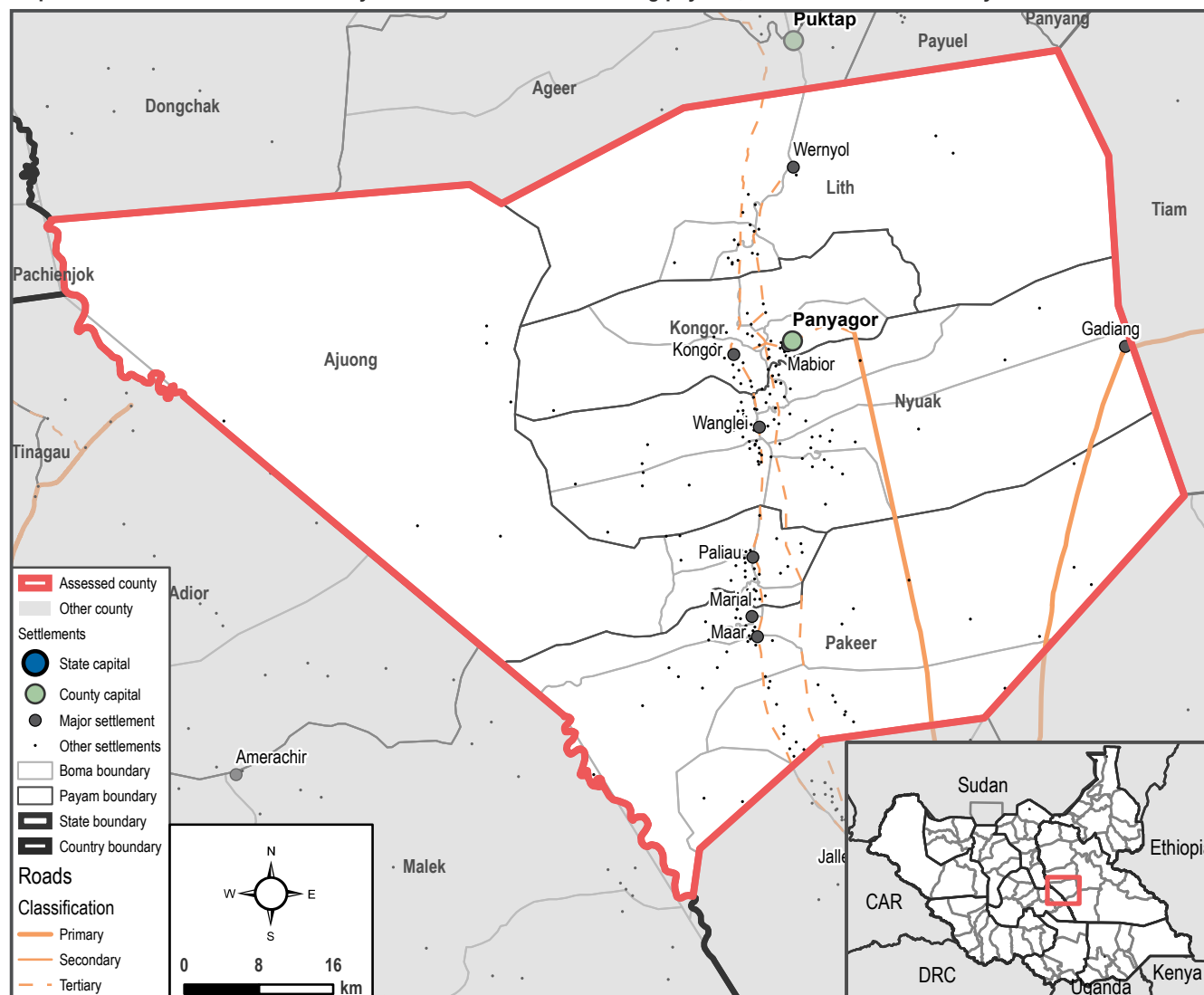




TWIC EAST COUNTY - JONGLEI STATE

Map 0.1. Location of Twic East County within South Sudan indicating payams, boma boundaries and key settlements



TWIC EAST COUNTY - KEY FACTS

- Estimated population: **121,100¹**
- Area: **5,944 km²**
- Population density: **21 persons per km²**
- County headquarters: **Panyagor**
- Payams: **Ajuong, Kongor, Lith, Nyuak, Pakeer**

Twic East county is located in the southwest of Jonglei state, bordered by Lakes State to the west. The population is centred around a central strip of higher ground running from south to north through the county, east of the Nile Basin. Wetlands surrounding the White Nile flood seasonally. However, more extensive flooding occurred in 2019-21, and in 2020 in particular, leading to largescale displacement to higher ground during this period.

Overall, the intensity of conflict has been lower in Twic East than in neighbouring counties.² In terms of infrastructure, markets and community services remain concentrated to the central strip of the county, with populations in more remote settlements potentially living long distances from key services.

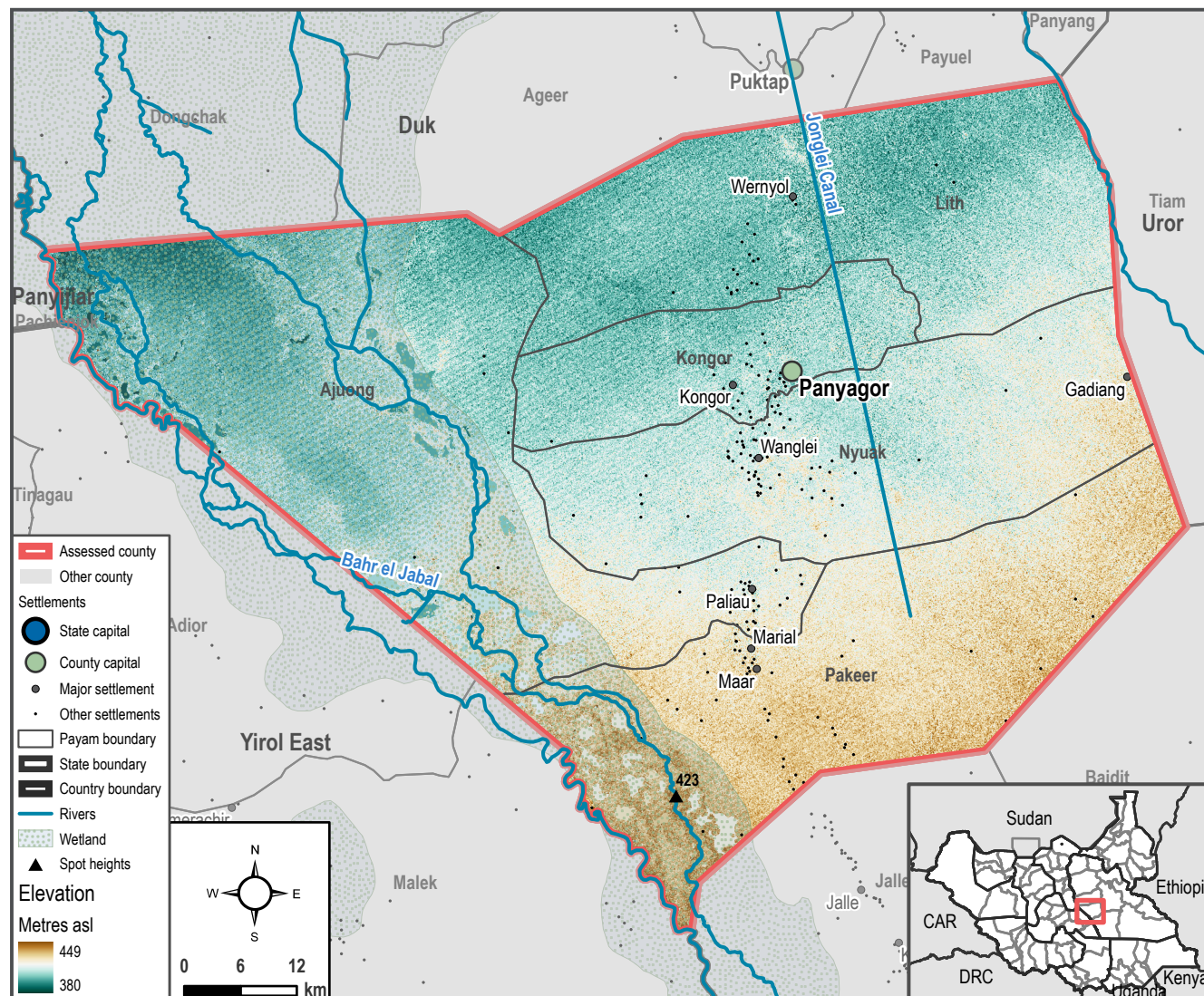
About REACH Initiative

REACH Initiative facilitates the development of information tools and products that enhance the capacity of aid actors to make evidence-based decisions in emergency, recovery and development contexts. The methodologies used by REACH include primary data collection and in-depth analysis, and all activities are conducted through inter-agency aid coordination mechanisms. REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Institute for Training and Research - Operational Satellite Applications Programme (UNITAR-UNOSAT).

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1. CLIMATE AND ENVIRONMENT

Map 1.1. Natural features including wetlands, rivers and water bodies in Twic East County. Elevation also shown.³



Highest point
449 m

Average elevation
416 m
Elevation range
69 m

Annual precipitation
854 mm/yr
Average temperature
28.1°C

Wettest month
August
Driest months
Dec-Jan

TWIC EAST COUNTY

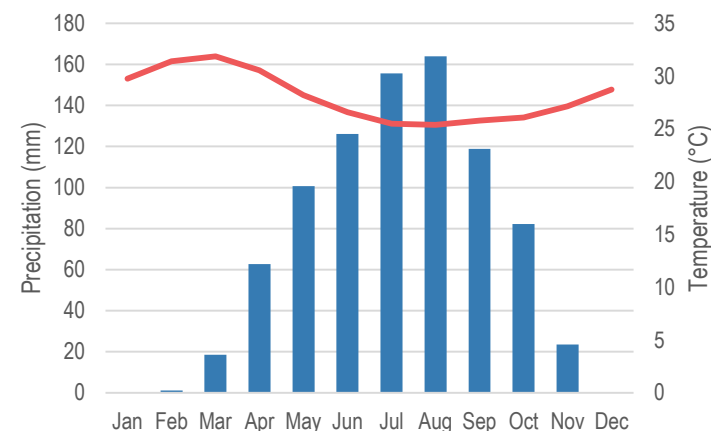
The **topography** of Twic East county is relatively flat (Map 1.1), with an **average elevation of 416 metres above sea level and limited elevation range**. Elevation gradually increases to the south of the county, eventually rising towards the Imatong Mountains further south on the border with Uganda. There are also some areas of marginally higher ground towards the centre of the county, where most of the population is concentrated.⁴

The **White Nile** river runs through the west of the county, **splitting into many different channels and forming the southern tip of a large zone of seasonally flooded wetlands known as the Sudd**. Vegetation is dominated by tall reeds and grasses such as papyrus, whilst soils in this area are high in clay, becoming sandy loam further from the main channels. The east of the county is dominated by savannah grasslands, bush thickets and dense acacia shrubs, with black cotton and sandy clay soils.⁵

The **incomplete Jonglei Canal** runs through the east of the county. The purpose of the canal was to divert water lost from the Nile in the Sudd swamps, but the project was stopped in the 1980s due to civil war.⁶

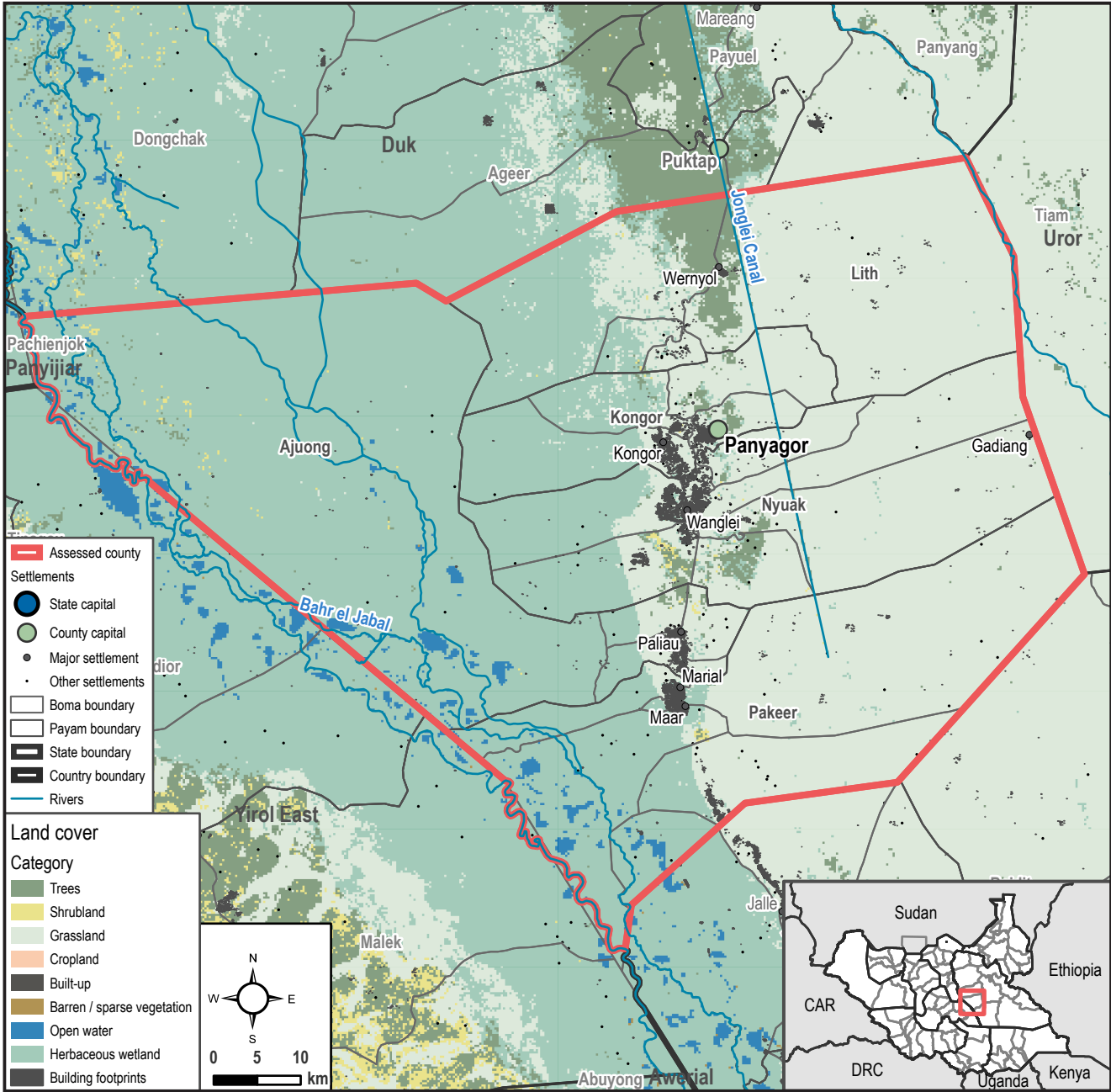
As with other parts of South Sudan, the county receives a large amount of rainfall, totaling 854 mm/year on average (Graph 1.1). There are two distinct seasons: a rainy season, which generally lasts between May and October, and a dry season; with January and December being the driest months, receiving almost no rainfall on average.⁷

Graph 1.1. Average monthly precipitation and temperature, Twic East County (1981 - 2021)^{8,9}



2. LAND USE AND LAND COVER

Map 2.1. Land use and land cover map, Twic East County¹⁰



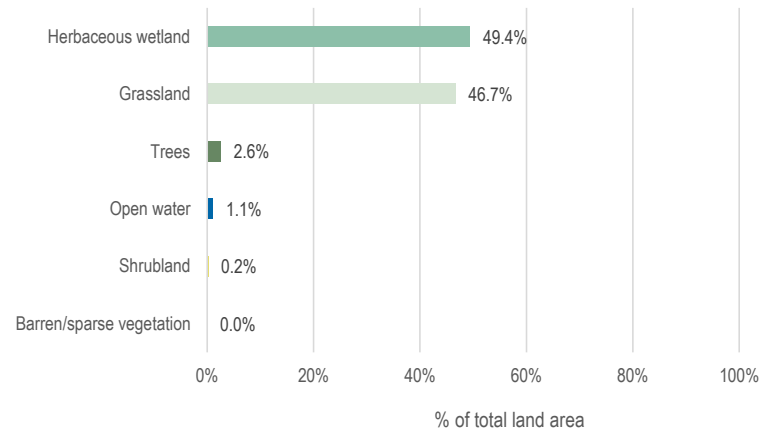
TWIC EAST COUNTY

Land cover in the western half of Twic East county is predominantly herbageous wetland with some areas of permanent open water. As mentioned, this wetland zone makes up the southern tip of the Sudd, the largest wetland system in Africa. The Sudd is characterised by seasonal expansion, usually between July and November each year, leading to **flooding on an annual basis. However, exceptional flooding, reaching more populated areas, can occur as explained in section 4.**

The eastern area of the county meanwhile is mainly grassland, with some areas of forest located to the west of the Jonglei Canal. **Most of the county's population is concentrated in the grassland area between the Jonglei Canal and the Sudd swamps.** (Map 2.1). Chart 2.1 indicates the land cover types as a percentage of the total county area.

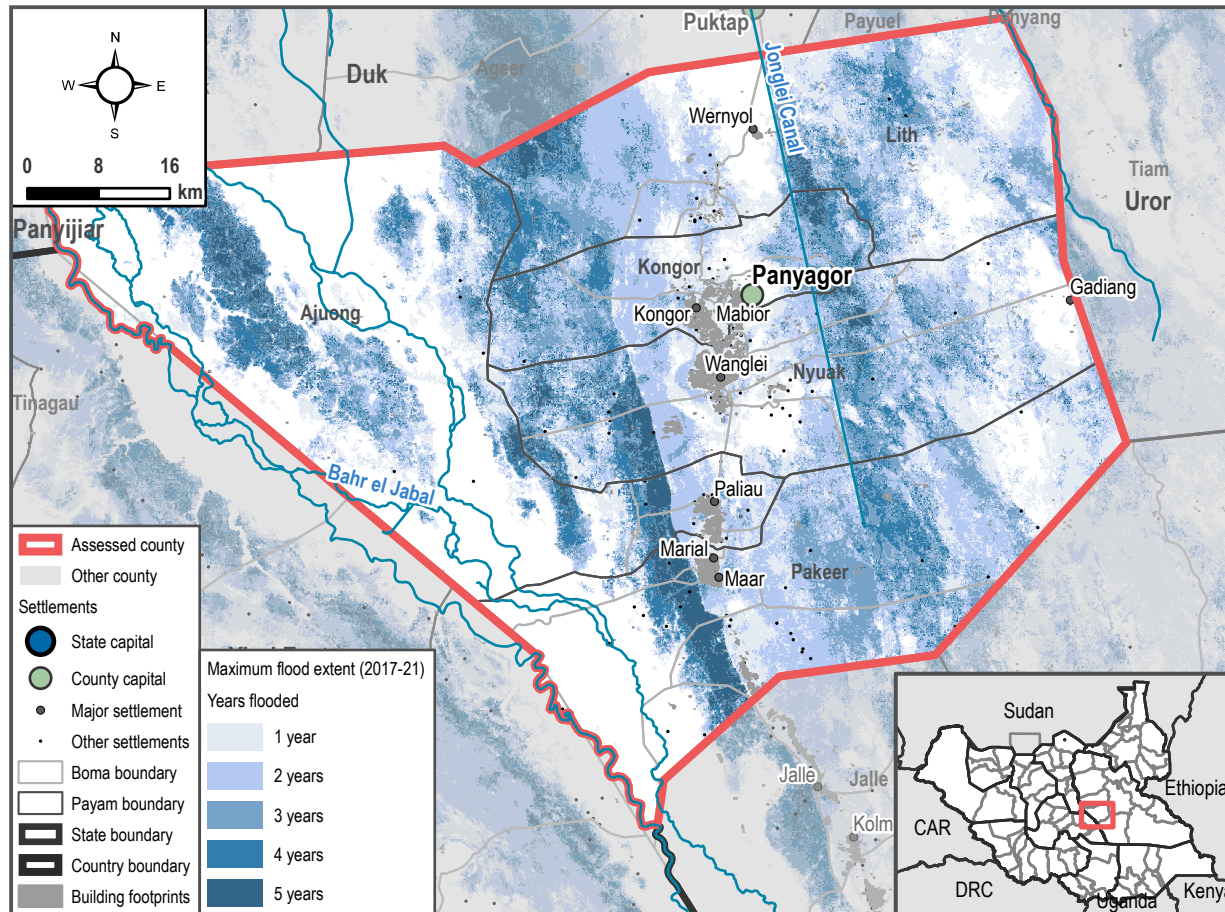
 **21,250** identified buildings in Twic East county¹¹

Chart 2.1. Land cover as proportion of Twic East county area

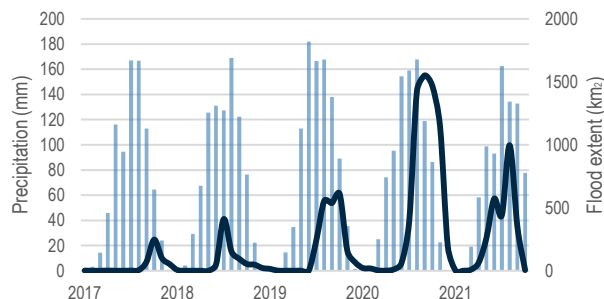


3. HYDROMETEOROLOGICAL HAZARDS - FLOODING

Map 3.1. Estimated maximum annual flood extent (2017-2021), affected settlements and key infrastructureⁱ



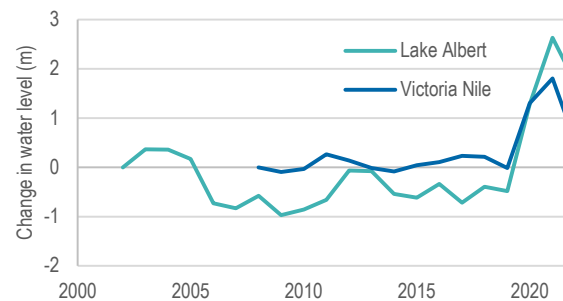
Graph 3.1. Area of flood extent vs rainfall (2017-21)¹³



ⁱ Estimated flood extent calculated based on analysis of [Sentinel 1 data in Google Earth Engine](#). Data is indicative only and has not been validated in the field.

ⁱⁱ Water level change calculated from [DAHITI](#) altimetry data for Lake Albert (ref. 85) and Victoria Nile (ref. 2264). Shows change in water level in metres from first year of data availability.

Graph 3.2. Changes in water levelsⁱⁱ upstream, Nile Basin¹⁴



TWIC EAST COUNTY

FLOODING

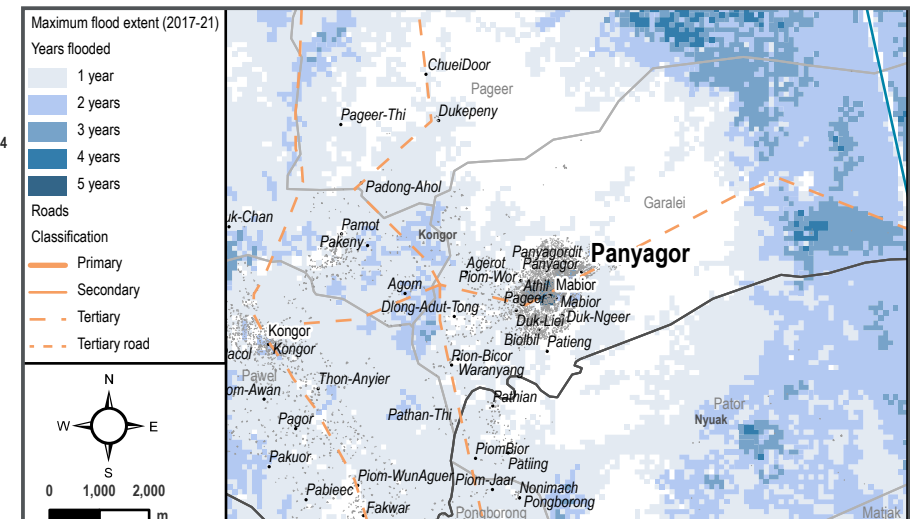
Over the past five years, **flooding has impacted all five payams of Twic East county (Map 3.1)**. During this period, the western floodplains and the area to the east of the Jonglei Canal were most frequently affected. The most extensive and long-standing flooding in this period occurred in 2020, followed by 2021 and 2019 (Graph 3.1).

While many parts of the Nile Basin in South Sudan are prone to seasonal flooding between July and November, **exceptional flooding was observed between 2019 and 2021, which resulted in considerable displacement to higher grounds (see section 6)**. Although less frequent, Map 3.1 shows that **flooding has also occurred around the county capital, Panyagor (Map 3.2)**, and the main population areas in the centre of the county, indicating this is more of an exceptional situation, potentially leading to greater impacts on the county's population.

KIs in 55% of assessed settlements in REACH's October 2021 Area of Knowledge (AoK) assessment¹² reported that people had left the county in the month prior to data collection. In these settlements, flooding was the most reported reason for their departure. See page 7 for more details on recent flood-induced displacement in Twic East county.

As Graph 3.2 shows, water levels increased significantly upstream on the Nile in 2020 and into 2021, leading to **greater influx of water into the Sudd wetlands and greater Nile Basin**. This, in addition to heavy rainfall in the area, appears to be a primary contributing factor to the flooding in recent years.

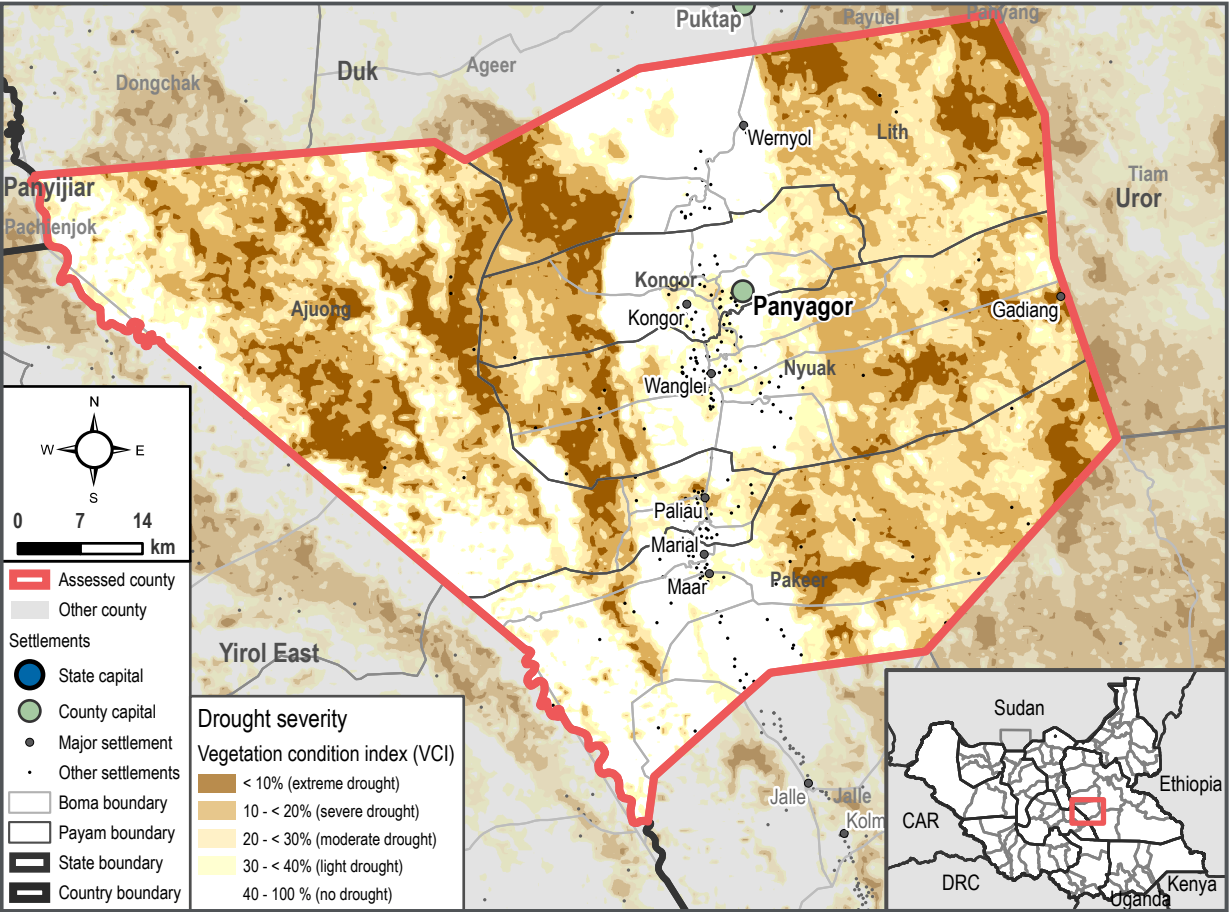
Map 3.2. Estimated maximum annual flood extent (2017-21), Panyagor area



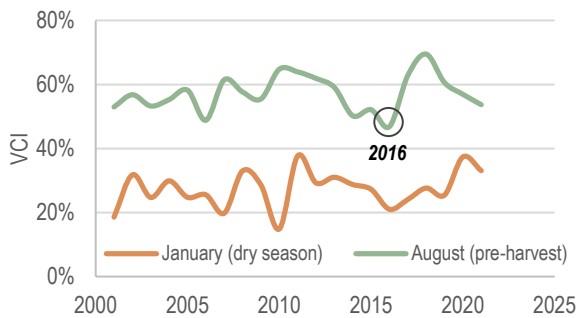
4. HYDROMETEOROLOGICAL HAZARDS - DROUGHT AND DRY SPELLS

TWIC EAST COUNTY

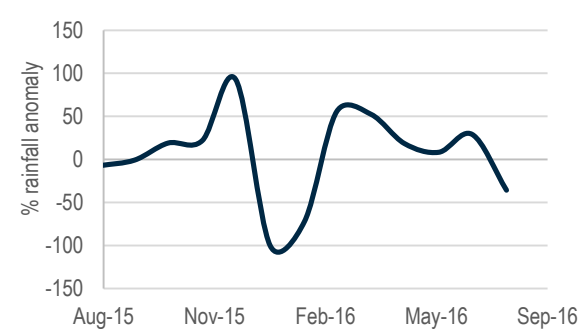
Map 4.1. Vegetation condition index (VCI), indicator of drought severity, in August 2016 - a detected drought periodⁱ



Graph 4.1. VCI (2000-2021) - drought index



Graph 4.2. Percentage rainfall anomaly in 2015-16¹⁹



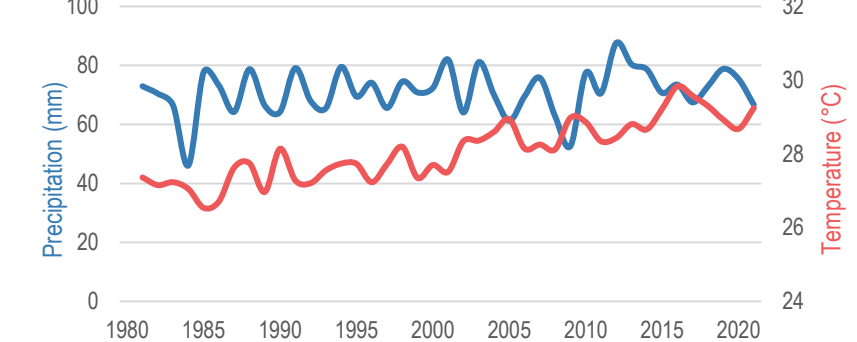
Much of South Sudan is exposed to droughts and dry spells driven by erratic rainfall and climate change. Graph 4.1 shows the vegetation condition index (VCI) in January (dry season peak) and August (pre-harvest) in Twic East. VCI indicates vegetation health compared to the long-term mean and values below 40% generally indicate drought conditions. In January, the largest dips in VCI can be observed in 2001 and 2010, whilst in August, 2006 and 2016 appear to be the most severe.

Map 4.1 shows the VCI in August 2016, which has the lowest average August VCI across the county in the past 20 years. Many areas appear to be affected by severe and extreme drought at this time, potentially affecting crop harvests, and the availability of wild food and surface water. Perhaps with the exception of the drought in 2009-2010 in Jonglei state, which was reported on in more detail,¹⁵ data on drought impacts in Twic East remains limited and may require future research. The 2016 drought may have been driven by dry spells in January and August 2016 (Graph 4.2), when rainfall was 100% and 40% below average respectively.

As Graph 4.3 indicates, temperatures have been steadily rising in Twic East county in recent decades, whilst precipitation appears to have been relatively erratic. If these trends continue, droughts could become more common due to reduced moisture availability. Future climate projections (based on the Shared Socioeconomic Pathway 370 emissions scenarioⁱⁱ), suggest that precipitation in the wettest month could increase by 38mm/month by 2060, whilst temperatures in the warmest month could increase by 2.3°C.¹⁶ Such increases in extreme conditions may lead to more intense and frequent climatic shocks, including droughts.

CLIMATE CHANGE

Graph 4.3. Long-term climatic trends (1981-2021), Twic East County^{17,18}



Projected climatic trends by 2060 based on ssp370 scenario, Twic East County²⁰

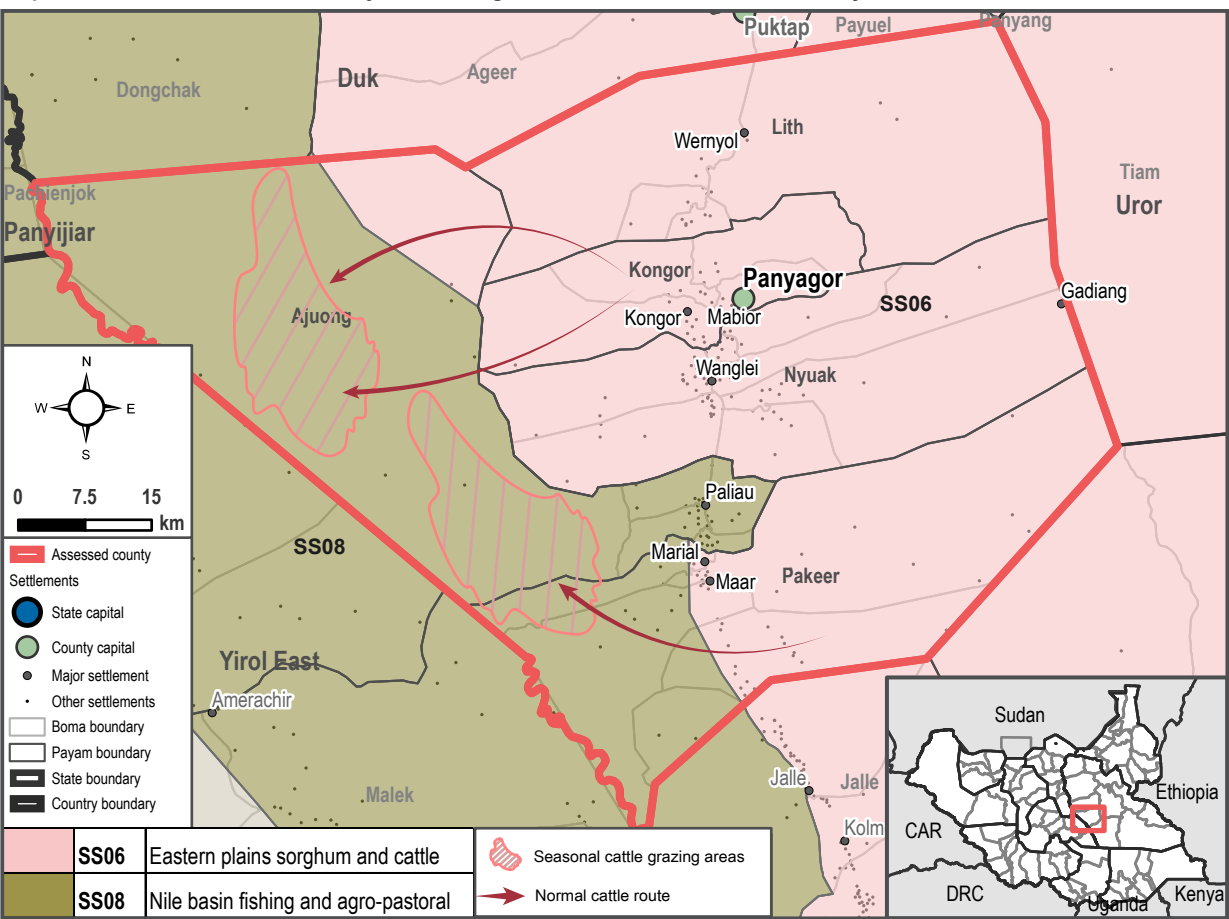
Projected change in precipitation in wettest month by 2060: +38mm/month
Projected change in max temperature in warmest month by 2060: +2.3°C

ii. Middle-estimate greenhouse gas emission scenario based on various socioeconomic assumptions.

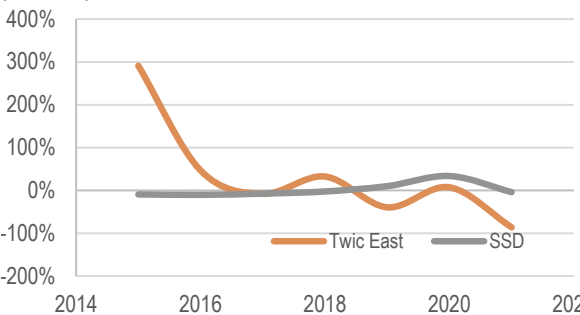
5. LIVELIHOODS AND SOCIOECONOMIC CONDITIONS

TWIC EAST COUNTY

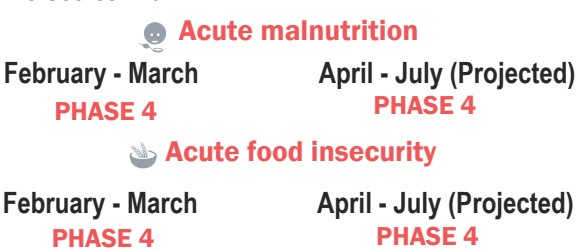
Map 5.1. Livelihood zones²⁹ and major cattle migration routes³⁰ in Twic East County



Graph 5.1. Year on year change in net cereal production (CFSAM)³¹



IPC Scores - 2022³³

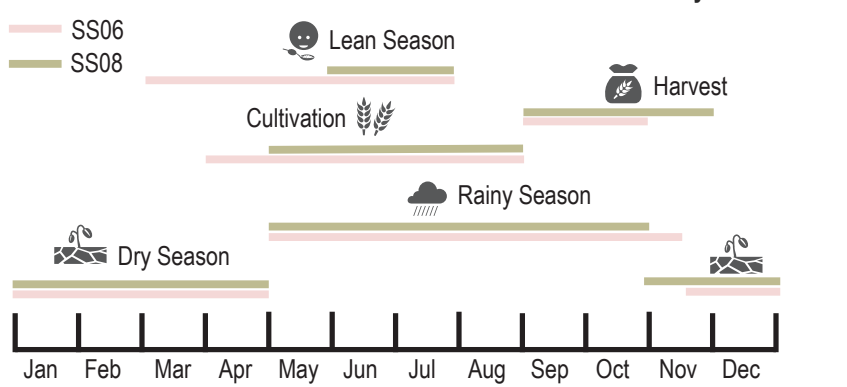


WASH indicators

60-79% of assessed households reported practicing open defecation (WASH Severity Classification, May 2021)³⁴

KIs in 75% of settlements reported most people took > 30 minutes to fetch drinking water (REACH AoK, April 2022)^{35,i}

Figure 5.1. Cultivation calendar for livelihood zones in Twic East county³²



According to the Famine Early Warning Systems Network (FEWSNET),²¹ there are two livelihood zones across the county (Map 5.1). Roughly defined by the Nile Basin, the western part of the county falls under the **Nile Basin Fishing and Agro-pastoral livelihood zone (SS08)**. Fishing and river-based production are more common here than in surrounding zones. Other natural resources include papyrus, wood, honey, and crude oil. Rain-fed farming is practised by most households, whilst livestock is commonly held and also brought in from other regions during the dry season.

East of the Nile Basin lies the **Eastern Plains Sorghum and Cattle livelihood zone (SS06)**. Livelihoods here are agro-pastoral, supplemented by fishing, hunting and collection of wild foods. Rain-fed cultivation is common, but exposed to flooding.²²

The Integrated Phase Classification (IPC) March 2022²³ analysis indicated **the county was in Phase 4 for acute food insecurity and acute malnutrition in Feb - March 2022, with these scores projected to July 2022**. Food insecurity is likely driven by various underlying vulnerabilities, with atypical flooding and protracted conflict affecting cultivation, livestock, and access to markets and humanitarian assistance in recent years.²⁴

Regarding WASH, open defecation is widely practised and the **WASH Severity Classification²⁵ flagged the county as in Phase 4 (Critical)** in May 2021. In addition, in the April 2022 AoK assessment, KIs in 75% of assessed settlements reported most people took 30 minutes or longer to fetch drinking water.²⁶

Map 5.1 also shows normal dry season cattle migration routes²⁷ from the drier grasslands in the east of the county to grazing areas close to the Nile in the west. In the January 2022 REACH AoK, **flooding and rising prices emerged as the main shocks to livelihoods**; each shock was reported in 50% of assessed settlements where livelihoods shocks had reportedly occurred in the month prior to data collection (69%).²⁸

i REACH AoK AoK data is collected at settlement-level and is based on reports by KIs. The methodology provides indicative data on the humanitarian situation including in hard-to-reach settlements. Only counties with 5% ccoverage of settlements are reported on.

6. POPULATION AND DISPLACEMENT

Map 6.1. Population density³⁷ across Twic East County (2020)

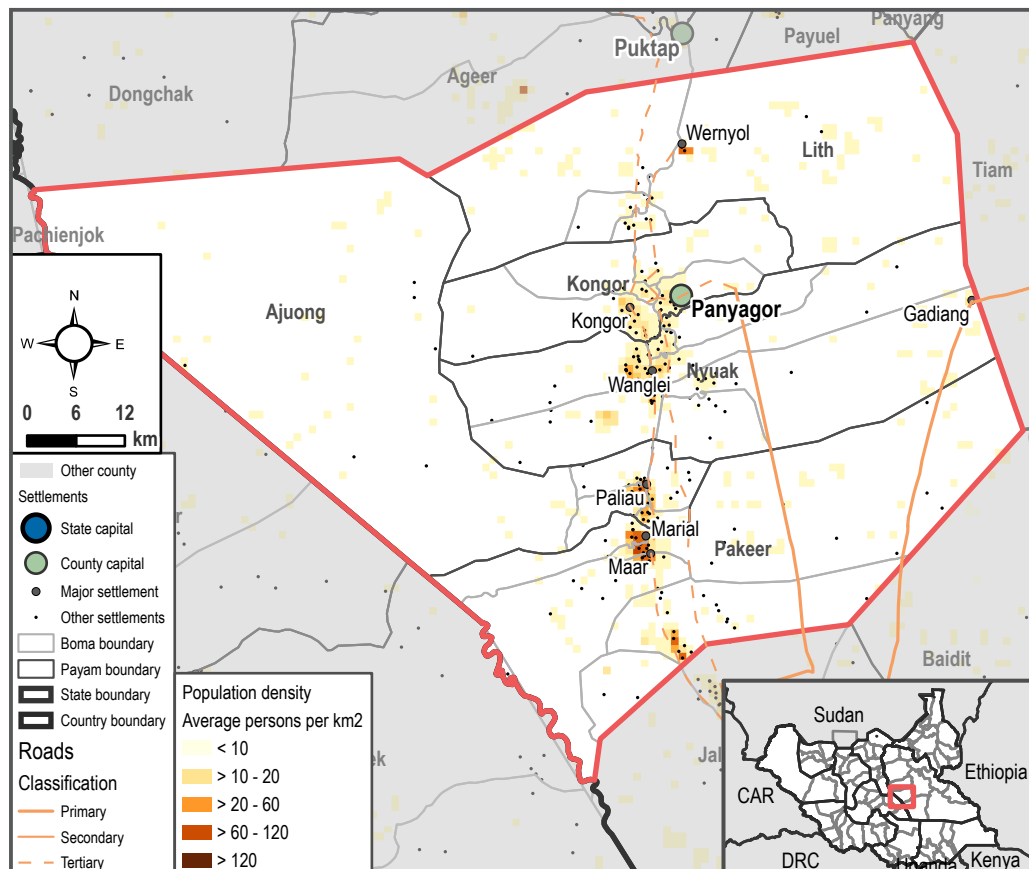


Table 6.1. Est. number of displaced persons by payam (2022)³⁶

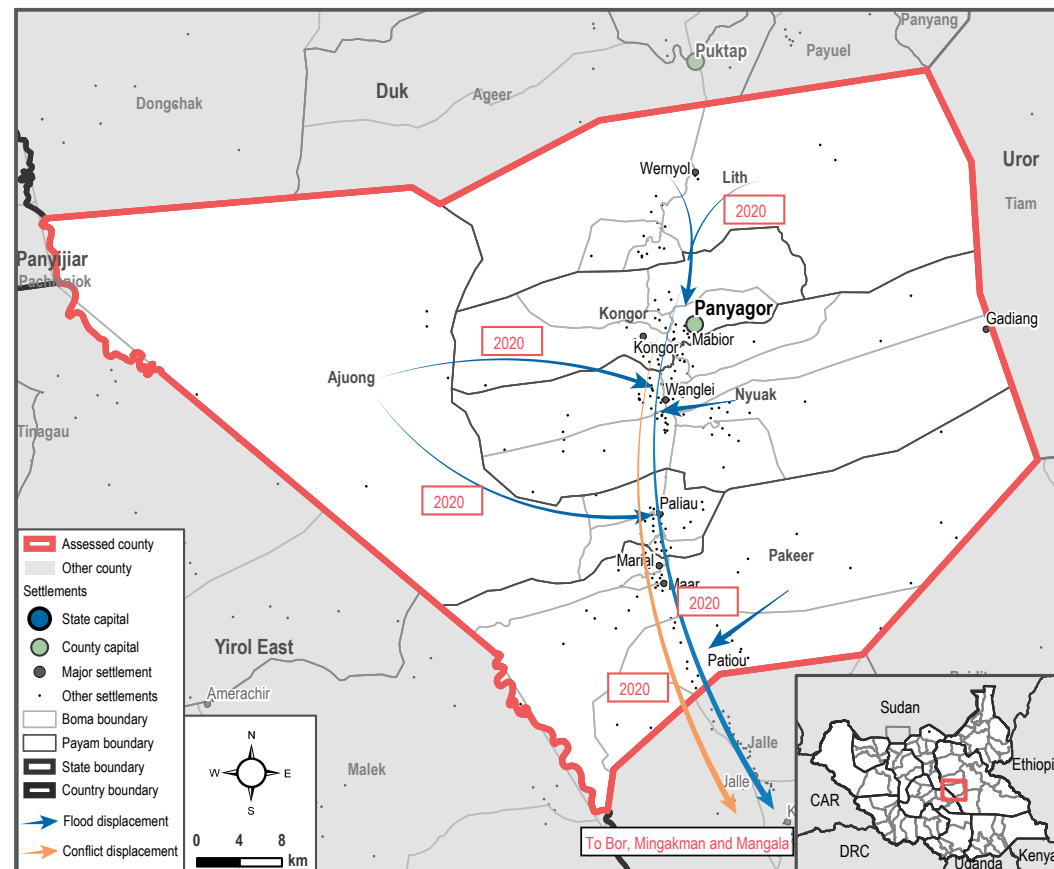
Payam	IDPs	Returnees	Relocated	Total
Ajuong	894	1,672	96	2,662
Kongor	1,516	1,238	24	2,778
Lith	892	616	24	1,532
Nyuak	1,931	1,498	-	3,429
Pakeer	644	3,870	35	4,549
County total	5,877	8,894	179	14,950

The population of Twic East county is concentrated in a the central strip running from south to north through the county, close to the main road routes and in an area of marginally higher ground. There is much lower population density to the east and west (Map 6.1). The most densely populated areas lie around the towns of Paliou, Marial and Maar. According to a 2022 International Organisation for Migration (IOM) Displacement Tracking Matrix (DTM) Baseline Survey, the **majority of internally displaced persons (IDPs) in the county were concentrated in Nyuak payam, followed by Kongor payam. The highest number of returnees was found in Pakeer payam (see table 6.1).**

Map 6.2 indicates some of the **major population movements in recent years in Twic East county.** In Pakeer Payam, over 4,000 residents were reported to have been displaced to Patiou area within the same payam due to extensive flooding in 2020, whilst over 3,700 people reportedly left Ajuong Payam for Palau. In the area of Nyuak, approximately 21,100 people left their homes for Wanglei and other areas of higher ground, whilst around 21,200 people in Lith payam were reportedly displaced to Panyagor town and other areas.³⁸ In addition, **as of August 2020, over 33,000 people were displaced from Twic East and Duk Counties to Bor town, Mingkaman and Mangalla, as a result of atypical flooding and insecurity.**³⁹

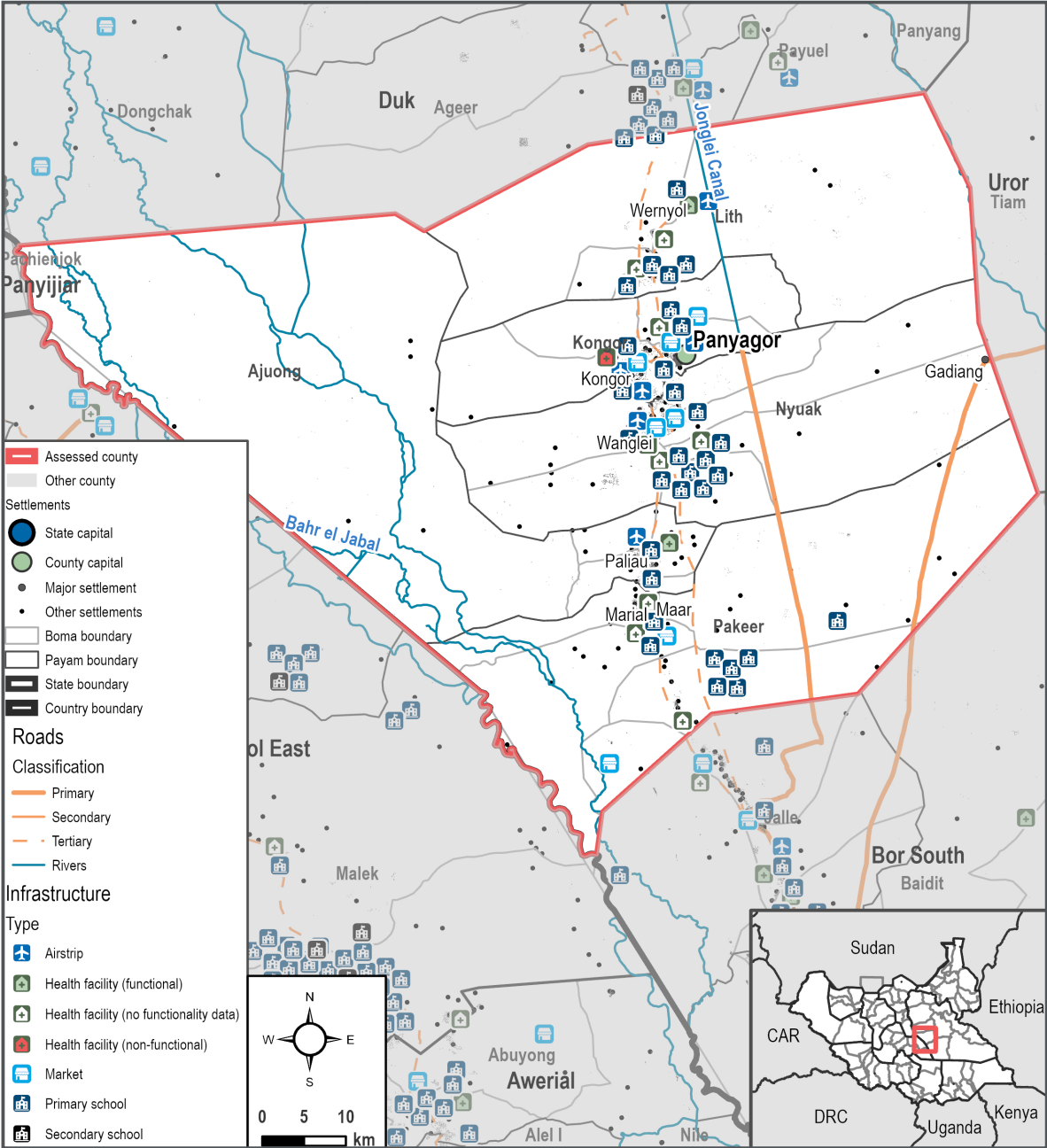
TWIC EAST COUNTY

Map 6.2. Significant population movements in Twic East county over the past five years (2017-21)



7. COMMUNITY INFRASTRUCTURE AND SERVICES

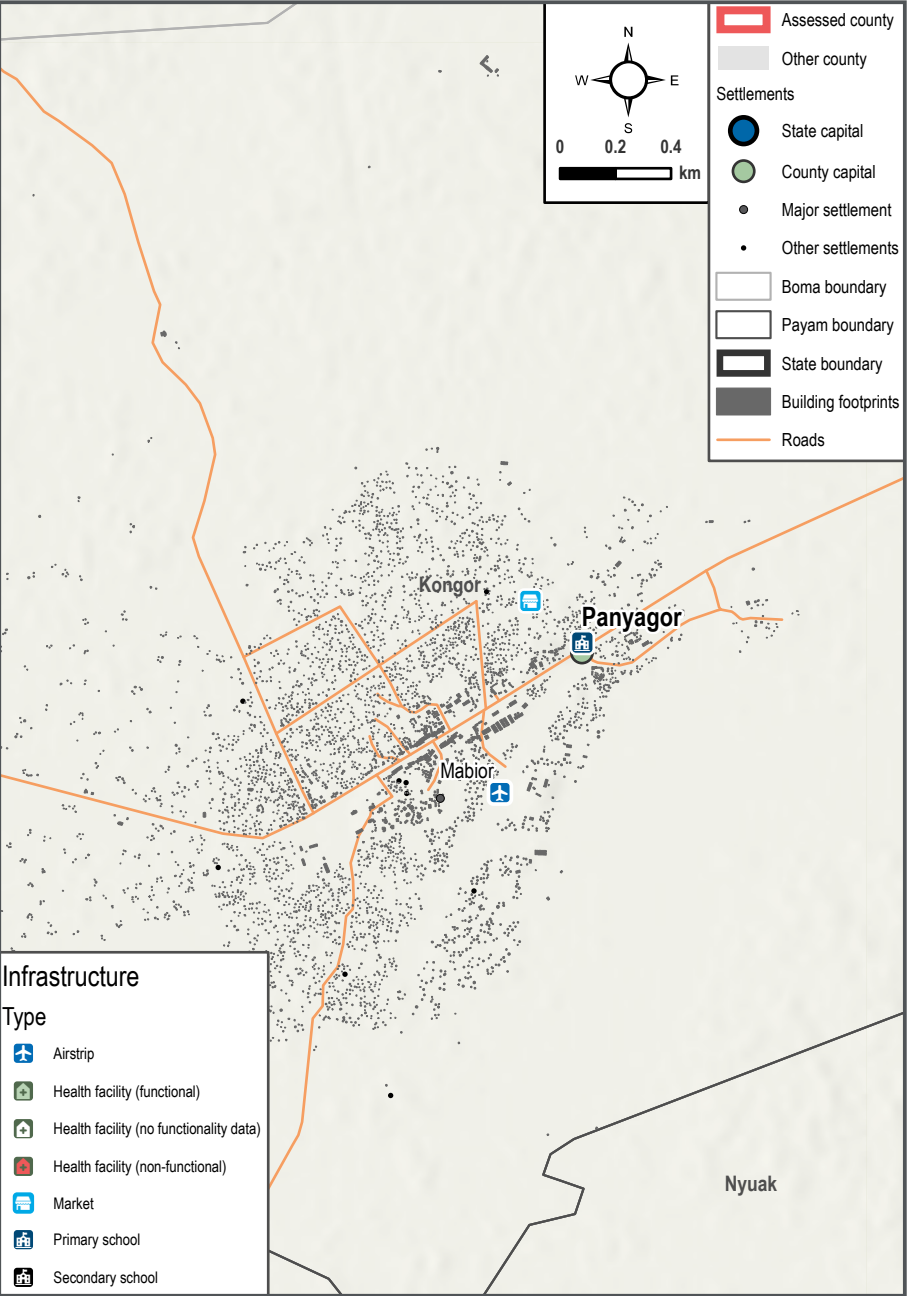
Map 7.1. Key infrastructure in Twic East County (2021)^{i,40,41,42,43}



i information on month of data collection is not available for health and education facility infrastructure data; airstrip data from September 2022; market data from August 2022.

TWIC EAST COUNTY

Map 7.2. Community infrastructure around Panyagor, Twic East County (2021)



8. SETTLEMENT CHANGE

TWIC EAST COUNTY

Figure 8.1. Satellite images showing change in built-up area in Panyagor town between 2011 and 2021.

Panyagor, 2011 (6 March 2011, WorldView 2 image)



Panyagor, 2021 (25 February 2021, WorldView 2 image)

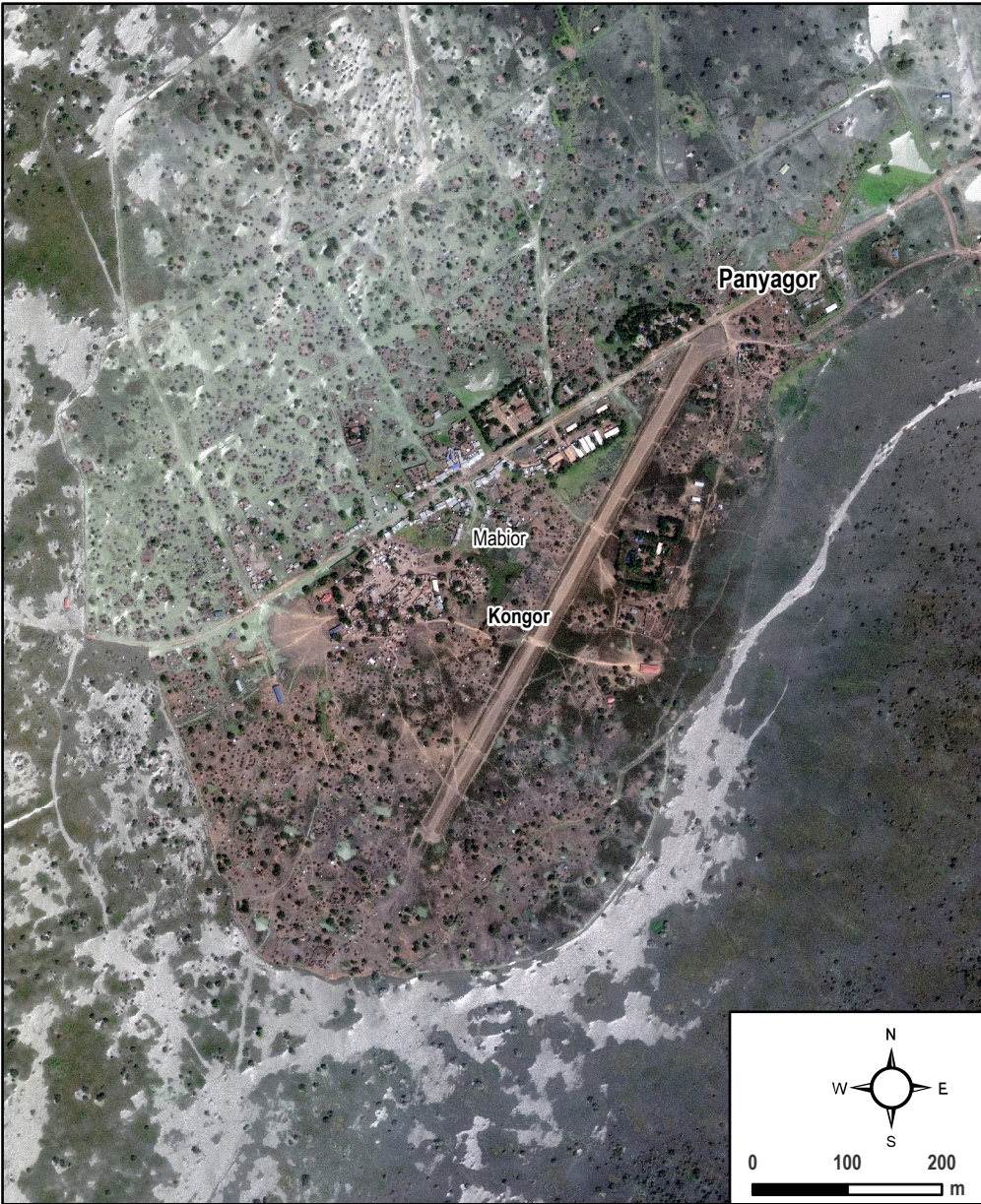
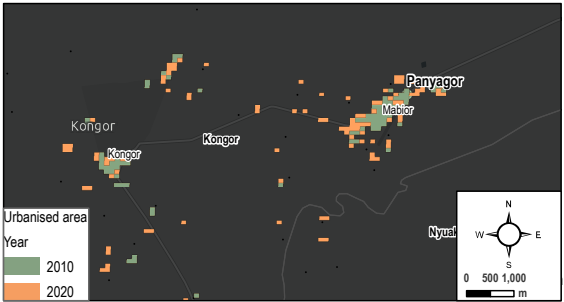


Figure 8.2. Change in urban area (2010-2020)⁴⁴



Satellite imagery: WorldView 2 from 6 March 2011. Copyright: ©2011 DigitalGlobe. Source: US Department of State, Humanitarian Information Unit, NextView License

Satellite imagery: WorldView 2 from 25 February 2021. Copyright: ©2021 DigitalGlobe. Source: US Department of State, Humanitarian Information Unit, NextView License

SETTLEMENT STRUCTURE

The county headquarters of Twic East are located in **Panyagor Town**, which sits around the centre of the county, east of the Nile Basin and close to the southern limit of the incomplete Jonglei Canal. Other key settlements in the county include Kongor, Paliau, Marial, Maar, and Wanglei.

Findings from REACH's AoK assessment at the end of the rainy season in **November 2021 indicated flooding had resulted in substantial damage to shelters**, with KIs in 34% of assessed settlements reporting up to half of all shelters had been destroyed by floods in the month prior to data collection.⁴⁵ According to most recent data (April 2022), while the tukul was the main shelter type (reported in 52% of assessed settlements), **temporary shelters remained common; rakoobas and tents were both the most reported main type in 22% of settlements.**⁴⁶

 **Shelter indicators - REACH AoK⁴⁷**

KIs in 52% of assessed settlements reported that the main shelter type used by local communities was a tukul (April 2022)

KIs in 34% of assessed settlements reported that up to half of shelters had been destroyed (and not yet repaired) in the month prior to data collection due to flooding (Nov 2021)

TRANSPORT

A major road runs from south to north through the central, densely populated strip of Twic East county from Bor to Malakal. Another road runs northeast to Akobo. **According to the Logistics Cluster, neither of these roads was accessible as of September 1st 2022, likely due to flooding.**⁵³

Due to limited road transport and access issues during the rainy season, transportation is mainly undertaken via waterways and air.⁵⁴ The White Nile provides an important source of riverine transportation through Twic East county (Map 10.1). The infrastructure map (p.8) indicates the location of the airfield in Panyagor serving the county.

*REACH AoK AoK data collected at settlement-level and based on reports by KIs. The methodology provides indicative data on humanitarian situation including in hard-to-reach settlements. Only counties with 5% coverage of settlements are reported on.

INFRASTRUCTURE

As of 2021ⁱ, 12 health centres⁴⁹ and 30 primary schools were spread throughout Twic East county.⁵⁰ At the time, assessment findings indicated there were **no secondary schools located within the county.** All health centres and primary schools appeared distributed relatively evenly throughout the central highly populated strip running north-south through the county. There is limited information on the functionality of these facilities.

Table 9.1. indicates the key settlements in Twic East county located the furthest from a health facility (excludes facilities

Table 9.1. Key settlements located the furthest from a potentially functioning health centre in Twic East county⁴⁸

Settlement	Distance (km)
Gadiang	35
Kongor	5.6
Mabior	4.3
Panyagor	4.2

Figure 9.1. Settlement change in Panyagor Town between 2010 and 2021 (largescale zooms from images on page 9)



ⁱ Information on month of data collection is not available

marked as non-functional). As shown, Gadiang is located the furthest away, at 35km. According to the REACH AoK survey in April 2022,⁵¹ **KIs in 50% of assessed settlements reported that most people were able to access a functioning health centre; a public health care centre (PHCC) in all cases.** In the majority of those settlements, KIs reported that it took people between **30 minutes to 1 hour to reach the nearest facility on foot.**

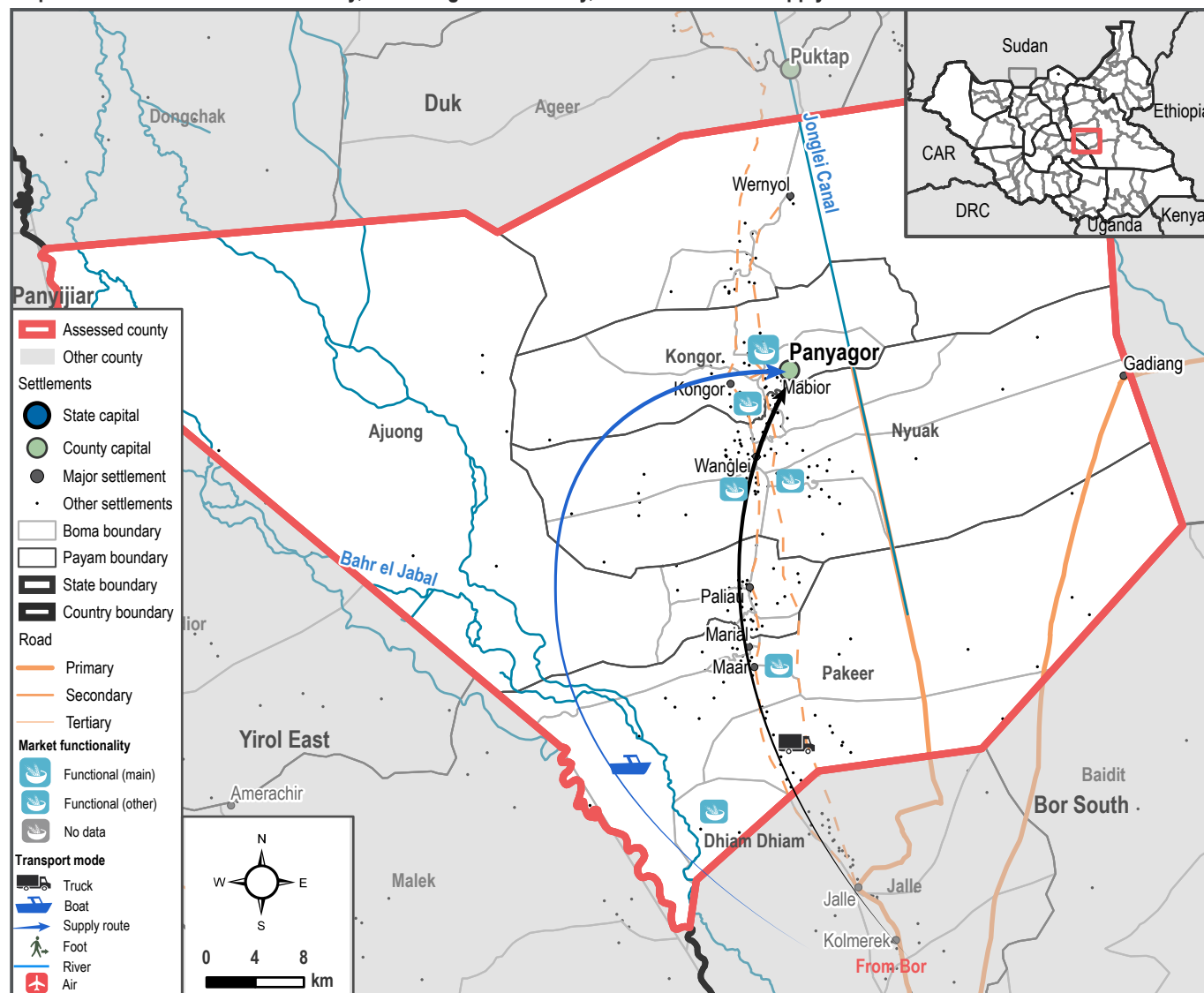
Findings from the most recent community capacity assessment (June 2020) indicated that **people in the majority of settlements had access to a functional cellular network (reported in 75% of assessed settlements).**⁵²

SETTLEMENT CHANGE

Observing the satellite imagery on page 9, one notable difference is the **development of dykes surrounding the town in 2021 and the movement of population to within the zone protected by these dykes.** As Figure 9.1 shows, there is a higher density of shelters within the dyke-protected core of the town in 2021. It appears that much of the land beyond the dykes has been eroded by flooding, whilst roads and tracks have been cut-off by the dykes and are less prominent in the imagery, suggesting reduced usage.

10. MARKETS, TRANSPORT AND ACCESSIBILITY

Map 10.1 Markets in Twic East County, indicating functionality, as well as market supply routes



Rice price (May 2022)

11% above South Sudan median

MSSMEB price (May 2022)

1.5% above South Sudan median

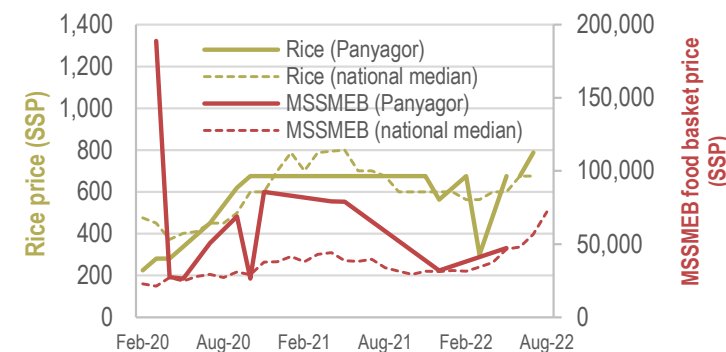
TWIC EAST COUNTY

As of August 2022, the **primary market serving Twic East county has between 50 and 100 traders and is located in Panyagor.** Additional smaller markets with less than 50 traders were located in Kongor, Dukchut, Wanglei, Maar and Dhiam-Dhiam⁵⁵. Panyagor market is served by road from Bor along the main north-south Bor to Malakal road running through the county, as well as via barges using the Nile river, also travelling from Bor.⁵⁶

In August 2022, REACH Joint Market Monitoring Initiative (JMMI) data indicated that **Panyagor market was running with reduced functionality, meaning that many items were not available.**⁵⁷ Functionality data is not available for other markets in the county.

Graph 10.1 below shows prices of rice and the Multi-Sector Survival Minimum Expenditure (MSSMEB) Food Basket in the county (as recorded at Panyagor market), plus national median prices. Whilst prices appeared to have increased in the past few months in response to high levels of inflation across the country, they were close to the national median as of May 2022. Excluding March 2022, when there was a large drop in the price of rice at Panyagor market, **rice prices have generally not shown major deviations from the national median, based on available data, over the past two years.** Whilst MSSMEB food basket prices in Panyagor were close to the national median in May 2022, they were **significantly higher in the months prior, reaching over 6 times the price of the national median in March 2022.** This occurred during the lean season and was probably mostly due to flooding resulting in poor harvests, and floodwater hindering access to markets.

Graph 10.1. Market price trends for riceⁱ and Multi-Sector Survival Minimum Expenditure Food Basket (MSSMEB).



ⁱ Rice selected as JMMI data limited for sorghum in Panyagor

ENDNOTES

- 1 IOM. County Population data. 2022.
- 2 Conflict Sensitivity Resource Facility (CSRF). [Twic East County Profile](#).
- 3 Google Earth Engine. [NASA SRTM Digital Elevation Model](#). 2000
- 4 ibid.
- 5 Famine Early Warning Systems Network (FEWSNET). [Livelihood Zone Map and Descriptions for the Republic of South Sudan](#). Issued August 2018.
- 6 Journal of Water Management Modelling. [Jonglei Canal Project Under Potential Developments in the Upper Nile State](#). 2018.
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- 10 Google Earth Engine. [ESA WorldCover v100. 2020](#).
- 11 Digitize Africa. Building footprints. 2017.
- 12 REACH [Area of Knowledge \(AoK\). October 2021](#).
- 13 REACH. [South Sudan Shocks Monitoring Index \(SMI\)](#). 2017-22.
- 14 DAHITI. [Altimetry data. 2002-2022](#).
- 15 ACT. [ACT Alert South Sudan No. 23/2009: Drought](#). 2009.
- 16 WorldClim. [Bioclimatic variables](#).
- 17 Google Earth Engine. [ERA5-Land Monthly Average Dataset](#). February 2022.
- 18 Google Earth Engine. [CHIRPS Daily Rainfall Data](#). 1981-2022.
- 19 ibid.
- 20 WorldClim. [Bioclimatic variables](#).
- 21 Famine Early Warning Systems Network (FEWSNET). [Livelihood Zone Map and Descriptions for the Republic of South Sudan](#). Issued August 2018.
- 22 ibid.
- 23 Integrated Food Security Phase Classification (IPC). [South Sudan Acute Food Insecurity and Acute Malnutrition Analysis](#). Feb - July 2022.
- 24 ibid.
- 25 REACH. South Sudan [WASH Severity Classification](#). April 2021.
- 26 REACH [Area of Knowledge \(AoK\). April 2022](#).
- 27 REACH [Seasonal Cattle Grazing Areas and Migration Map](#). 2020.
- 28 REACH [Area of Knowledge \(AoK\). January 2022](#).
- 29 Famine Early Warning Systems Network (FEWSNET). [Livelihood Zone Map and Descriptions for the Republic of South Sudan](#). Issued August 2018.
- 30 REACH [seasonal cattle grazing areas and migration map](#). 2020.
- 31 FAO/WFP. 2021 Crop and Food Security Assessment Mission ([CFSAM](#)) to the Republic of South Sudan. June 2022.
- 32 Famine Early Warning Systems Network (FEWSNET). [Livelihood Zone Map and Descriptions for the Republic of South Sudan](#). Issued August 2018.
- 33 Integrated Food Security Phase Classification (IPC). [South Sudan Acute Food Insecurity and Acute Malnutrition Analysis](#). Feb - July 2022.
- 34 REACH. South Sudan [WASH Severity Classification](#). April 2021.
- 35 REACH [Area of Knowledge \(AoK\). April 2022](#).
- 36 IOM - DTM [Baseline Survey](#) 2022.
- 37 Google Earth Engine. [WorldPop](#) Global Project Population Data. 2021.
- 38 Radio Tamazuj. [Floods cut off Twic East County, residents displaced](#). 2020.
- 39 Relief Web. [South Sudan: Floods](#) - Aug 2020.
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