

Perisa Ashar
Maggie L. Walker Governor School
Richmond, Virginia
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South Sudan: Tackling Food Insecurity Through Advanced Irrigation

South Sudan, known as the “newest and youngest nation of the world,” has a population of about 13,254,040 people (“South Sudan Population (LIVE),” 2019). The majority of South Sudan is an agricultural-based economy, as there is about a 20.2% urban population. After following a referendum that was overwhelmingly supported, South Sudan was recognized as a separate country than Sudan in 2011 after 40 years of civil war. More than 2.5 million people killed and 4.5 million were displaced in this civil war. Devastated by this conflict, South Sudan saw a hindrance in its basic infrastructure, human capital, and formal civilian institutions. After adopting a new constitution in December 2005, it established a mixed presidential government. This system allowed the president to lead the state, government, and its military forces. Along with the president, two vice presidents and several ministers (currently twenty-nine) compose the cabinet (Misachi, 2017). In 2013, political tensions significantly increased among major South Sudanese leaders. Pre-existing ethnic and political grievances led to armed clashes and targeted ethnic killings in the capital Juba, and then spread throughout the country.

Seventy-five percent of South Sudan’s land area is suitable for agriculture. About 330,000 square kilometers (about half of the total land space) can be suitable for cultivation, around the size of Vietnam (“Development of Agriculture in South Sudan,” 2018). Some of the major exports of South Sudan include crude petroleum, scrap iron, aircraft parts, and swan wood (“South Sudan,” 2019). The major crops and exports in South Sudan are cereals (sorghum and maize), millet, and rice. Agriculture continues to be a subsistence activity by smallholder farmers utilizing simple elements, as the average farm size is in the range of 0.4 to 1.7 hectares. Major factors of these values are that intensive farming with little fertilizer application has continuously lowered yield and depleted soils (“Development of Agriculture in South Sudan,” 2018).

Located in eastern Africa, Sudan is a land-locked country that borders the South of Sudan, the north of Uganda and Kenya, and the west of Ethiopia (“The World Factbook: South Sudan,” 2019). South Sudan has a hot climate with seasonal rainfall, impacted by the annual shift of the Inter-Tropical Convergence zone. Rainfall is heaviest in the upland areas of the south of this country, and gradually diminishes towards the north. Due to overall constant temperatures, the most significant variables of food productions are rainfall and the length of the dry season. In May, the sun makes way for clouds to begin the rainy season, and the wettest months occur in August and September (“Climate and Average Weather in South Sudan,” 2016). From October to April, South Sudan is impacted by dry climates, with practically no rainfall nationwide. Due to no access to irrigation, rainfall is the single-most important factor for food production. Since the previous year’s food stores run thin and the subsequent harvest is not until the following September, April is the beginning of a phenomenon known as the “Hunger Gap.” During this time period, citizens rely on the cow’s milk as a vital energy source. Six-foot tall grass can burn, resulting in haze and falling ash during the dry weather (Pike, 2013). At the end of April in 2018, the rainy season was and still does not come with all benefits. The rains are also a major hindrance to access in outlying areas, which cannot be accessed by road once the initial rains have started. Once the rainy season finishes, there is expected to be at least some local food production, which can be helpful during the dry winter season (Jerving, 2018).

In 2017, the average household size was about 5.9 members. The households in South Sudan typically follow a matriarchal system. About 62% of females (who have a child under 15) is the head of the family household. Traditional homes in South Sudan are constructed out of natural, local sources. About 90% of homes are grass thatched mud huts. While the primary material utilized for walls is mud or brick, studies have shown that while these mud bricks may be the most economical, they are definitely not the most durable in South Sudan’s weather conditions. Due to the hot weather, the roofs in South Sudan tend to be high, sloped, or/and conical, in order for heat to rise out through the top (Little and Kalyoncu, 2019).

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Unfortunately, South Sudan faces a Phase Four level food emergency, which occurs when more than 15% face malnutrition, an escalating number of people die from starvation, and the average diet is limited to two or three food groups (Hornor, 2017). Sorghum continues to be one of the main exports of South Sudan, and is a vital staple food in the citizens' diets. This grain can be cooked and eaten alone, or utilized to make *kishra* (a traditional South Sudanese flatbread). Corn is used for making pancakes or porridge. Within the three Equatorias, maize flour has proven to be a reliable food source (provided the soil is suitable), and groundnut (cultivated on sandy soil) makes an important contribution to the typical household diet ("Development of Agriculture in South Sudan," 2018). To have a consistent food supply during the wet and dry seasons, citizens typically combine livestock and agriculture. This practice is essential in the Jonglei state, where agriculture is only the focus during the wet season, and animals for the dry winter. Cow and goat milk are consistently consumed and due to lack of food harvesting, citizens will typically eat all parts of the livestock as well (Hornor, 2017). Typically, many South Sudanese families gather food from harvesting crops on their fertile lands (located in places like the Jonglei state). However, due to the ongoing conflict in South Sudan, about 70% of the people were forced to flee their homes in the Jonglei State. These citizens rely on organizations like the World Food Programme to "airdrop" food. The food supplies from the neighboring state of Sudan have recently shrunk due to insecurity along the routes that trucks pass in order to get to Kodok (Fominyen, 2015). Lack of fuel to cook food also affects several South Sudanese citizens. Sometimes, women and children venture out of the UN refugees camps the manned boundaries to obtain firewood or purchase charcoal, which can be risky ("South Sudan," 2014).

Large numbers of young men in South Sudan are jobless, due to the extensive competition and higher qualifications being demanded. If employed, several male youths are engaged in casual labor, and have extremely low wage rates. Formal private sector employment opportunities have been scarce, since private companies state that workers from East Africa have more skills and are cheaper to hire. A 2001 study also reported that an urban cash economy resulted in the greater dependence on "petty trade" by women. Since men were unable to fulfill the roles of providing and protecting their families, women began to replace them as the main breadwinners. Women started to run small market businesses or engage in informal livelihood activities (Martin, 2010). In July 2013, two years after South Sudan became independent and prior to its civil war, a teacher or a government worker earned about \$477 per month. As of 2018, five years after the war, that same teacher or government worker only earns around \$8, due to the devaluation of the Sudanese pound. Sometimes, a chicken is worth more than one's two monthly wages added together, and only half a gallon of milk costs nearly half of a teacher or government worker's budget, at \$3.70 (Thompson, 2019).

More than 2,000,000 children or over than 70% of children are out of school. Many of them instead inhabit pastoral communities to live off of cattle. Girls constitute the largest group of out-of-school children. UNICEF has stated that a child born to an educated mother has a 50% higher chance of survival ("Education," 2019). Several South Sudanese citizens do not have access to proper health care, due to the lack infrastructure and the poor state of existing health facilities. There are only 189 physicians nationwide, which equates to one doctor per 39,088 citizens. About 51% of physicians are located in the Central Equatoria State, while the western Equatoria and Jonglei states do not have any physicians ("Access to Health Care in South Sudan," 2016). Safe water is scarce in South Sudan. The primary source of water in camps and communities is rainwater. Obtaining water from wells has shown to be insufficient as it leads to community conflict and is quite time-consuming for women to wait in a queue ("South Sudan Gender Analysis," 2016). While the South Sudanese government has tried to create a goal to reduce the number of people who do not have sustainable access to safe drinking water and sanitation by 50%, there is not a government policy nor a safe drinking water programme in place to accomplish this aim (Joseph, 2014). South Sudan has extremely poor infrastructure. The civil war negatively impacted South Sudan's telecommunications network, as the landline telephone network seems to be non-existent (Powell, 2012). While South Sudan has about 10,000 kilometers of roads, only 2% of them are paved. Since electricity is mainly produced by expensive diesel generators

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(considering that there is a scarcity of indoor plumbing and portable water), less than 2% of the country has access to electricity (“The World Factbook: South Sudan,” 2019).

Violence from the South Sudan civil war has played the biggest impact on food insecurity. The civil war began from deep-rooted tensions between the Dinka (South Sudan’s largest tribal ethnicity) and the Nuer (second largest). This civil war initiated in December 2013, when South Sudan’s Dinka President Salva Kiir accused former Vice President Reik Machar (a Nuer) of encouraging a coup. Not only did Machar deny this accusation, but he also criticized Kiir’s inability to tackle corruption and his aspiration to “Dinka-nize” South Sudan’s government. Before Kiir could send soldiers of the Sudanese People’s Liberation Army (SPLM) to arrest Machar, he had already fled to lead the Sudanese People’s Liberation Movement- In Opposition (SPLM-IO). Consequently, the Dinka SPLM personnel and militia groups killed hundreds of Nuer soldiers and civilians around the capital of Juba (“South Sudan: Post Civil War Instability,” 2019). All parties of the civil war conflict committed substantial abuses, including indiscriminate attacks against civilians including aid workers, unlawful killings, beatings, arbitrary detentions, torture, sexual violence, recruitment of child soldiers, and looting and destruction of civilian property including arable farmland (“World Report 2019: Rights Trends in South Sudan,” 2019) After five years of civil war, President Salva Kiir and Riek Machar finally began peace talks in Ethiopia and Sudan, regarding the several people that were killed and displaced from their family members (“South Sudan Rivals Meet in Khartoum for Peace Talks,” 2018). At the end of June, Kiir and Machar signed the Khartoum Declaration of Agreement, which included a cease-fire and a pledge to negotiate a power-sharing agreement to end the South Sudan war. However, due to sporadic violations still occurring, President Kiir and Machar signed a final cease-fire and power-sharing agreement in August 2018. In September 2018, a peace agreement called the Revitalized Agreement on the Resolution of the Conflict in South Sudan was signed by the government, Machar’s opposition party, and several other rebel factions (“Civil War in South Sudan | Global Conflict Tracker,” 2019).

Although the United Nations has stated that the levels of political violence have dropped significantly due to the past cease-fire agreements, ethnic violence (like rape, murder, and theft) is still carried out. Studies have shown a strong correlation between the ethnic violence in South Sudan with food insecurity, causing households to endure large-scale asset losses and livelihoods disruptions for years (Bruck and d’Errico, 2019). More than 4,000,000 people are displaced due to conflict and hunger, out of which 2,000,000 have fled to neighboring countries since December 2013. Uganda has about 800,000 refugees in 2019, in which 60% of them are children. The effects of the past five years of war and chaos are negatively affecting the population, as the lack of food is at a crisis level. Displaced families have been unable to farm and feed livestock, and food prices have risen substantially. Aid groups also have trouble accessing remoted areas of South Sudan with relief supplies (“South Sudan conflict, hunger: Facts, FAQs, and how to help,” 2019). The overall plan for irrigation development after the war of 1983 was to irrigate about 270,000 ha of land. Due to the current conflict of the civil war, these plans have not been pursued (“Development of Agriculture in South Sudan,” 2018). In 2017, hunger caused more than two deaths each day for every 10,000 people during the war (“South Sudan conflict, hunger: Facts, FAQs, and how to help,” 2019). Below-average rainfall delayed the start of the 2019 planting season and limited pasture regeneration, keeping livestock body conditions poor.

One political solution to the South Sudan civil war was the Revitalized Agreement on the Resolution of the Conflict in South Sudan, which officially declared the end of the civil war. While it helped with the decreased violence, one major flaw is that it divides South Sudan into a “patchwork of tribal homelands”, rather than a country and including multi-ethnicity areas. Minorities will not be able to participate in the local government nor have the right to the conventional utilization of land. Therefore, this suppression of large sections of South Sudan can give the opportunity for future tribal leaders to take advantage of the existing ethnic tensions to pursue their own aspirations (“South Sudan: Post Civil War Instability,” 2019). Some other opposition groups also declined to sign the agreement (“Security

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Council” 2018). Economic pressure from countries trading with South Sudan (including China, India, Uganda, Ukraine, and Jordan) thus needs to be exerted on the opposition groups until they forfeit their guns (“South Sudan,” 2019). The Intergovernmental Authority on Development (IGAD) must work with the United Nations Security Council to determine the size of peacekeeping forces to maintain peaceful cooperation between various ethnic groups in South Sudan.

Another source of aid is the billions of dollars that the United States has sent to South Sudan for food aid. Being the biggest donor, the U.S. has given about \$1,780,000,000 since the beginning of the civil war (and including \$336,000,000 in 2018). In May 2018, the Trump administration threatened to cut funding in South Sudan unless the civil war conflict ended (which it did in September). Fortunately, the aid from the U.S. will still continue to help South Sudan rebuild its economy. However, one disadvantage was that the UN Secretary-General stated that South Sudanese government and opposition forces purposefully prevent food from getting to malnourished or underdeveloped areas in 2017 (Thompson, 2018). The denial of aid had caused an extreme food insecurity throughout the population, with malnutrition and death by starvation (especially in the Greater Baggari area) (Nichols, 2017). However, the information minister of South Sudan has stated that while time progresses after the signing of the Revitalized Agreement, the economy will improve. Therefore, if officials continue to steal food from the civilians, then countries trading with South Sudan can implement sanctions and refuse to buy their exports (like petroleum fuel), thus proving economic pressure.

In 2007, South Sudan with the Ministry of Water Resources and Irrigation (MWRI) developed the “Water Policy for South Sudan,” which encouraged social development and economic growth by “promoting efficient, equitable, and sustainable development” in water resources and sanitation. In 2011, the MWRI successfully established the Water, Sanitation, and Hygiene (WASH) Strategic Framework to identify priorities in water resources management, sanitation, and hygiene. However, this strategic plan fails to brainstorm programs that can conserve water, facilitate runoff, and help groundwater recharge—which are all factors vital in areas where the rainfall may be limited or during the dry season (Fernando and Garvey, 2013). Thus, the South Sudanese government should divert more funds into the Ministry of Water Resources and Irrigation to continue the initial plan of irrigation development (that had been halted during the civil war), as South Sudan has rich land and water endowment. The locations for potential areas of irrigation development for having food security and improving water management include the lowlands (where farmers utilize flooding in order to supplement water for rice), areas next to the river floodplains (where farmers cultivate short-maturing sorghum varieties), and areas around swamps/marshes (where the extension of the food-production season is made possible by planting in moist soils left by receding floods) (“Development of Agriculture in South Sudan,” 2018).

Although South Sudan is the “youngest country” and recently gained its independence, it has been in the middle of a brutal civil war due to ethnic divisions. Because of delayed rainfalls and the civil war, many families have abandoned their farmlands. Nonetheless, there is still potential for South Sudan to revitalize their economy through the drought season by investing in advanced irrigation systems, as well as holding the government accountable when citizens are not receiving the proper food aid from the United Nations.

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