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## **South Sudan and Hunger: How Drought Resistant Maize Could be the Solution to South Sudanese Food Insecurity**

"The freedom of a man, I contend, is the freedom to eat"- Eleanor Roosevelt. South Sudan is a young but resilient country, who has, in its poverty, become synonymous with hunger. And while there are many ways to alleviate hunger, there is only one way to resolve it. The implementation of new agricultural technologies and the education on how to use these technologies are essential, not just to resolve hunger but also to prevent it. Like many African nations, South Sudan has become increasingly vulnerable to human-made climate change. As a result, the country's agricultural industry has become less reliable, leaving more people without access to a sufficient diet. The continual introduction of drought-resistant maize in tandem with an advanced system of integration through education will not just solve South Sudan's food insecurity; it will ensure that South Sudan remains food secure for years to come.

South Sudan is a landlocked country with a hot, seasonal climate, with heavy rainfall in the south and less in the north. The terrain rises from plains in the north to highlands in the south, and through the country runs the White Nile River. A unique feature of South Sudan is the Sudd, a vast swamp formed by the Nile River and Sudan's prominent geographical feature, taking up 15% of the country. (The World Factbook 2021)

Within South Sudan are an array of tribal societies with their own social structures and laws. The Government of South Sudan is a Presidential Republic; however, this government has little power, as 90% of criminal and civil matters are dealt with through tribal courts. Marriage, divorce, and child custody are all considered matters of the home rather than the state. ("globalEDGE")

4.3% of the land is cultivated, with the average farm size being 0.4-1.7 hectares (South Sudan Infrastructure Action Plan - a Program for Sustained Strong Economic Growth - Chapter 6 - Development of Agriculture in South Sudan), with the significant exports being oil, forage crops, cotton, gold, and dried legumes. These products are typically exported to China, UAE, India, Pakistan, and Uganda. ("South Sudan (SSD) Exports, Imports, and Trade Partners")

The population of South Sudan reaches roughly 11,000,000, 80% of whom live in rural settings ("Rural Population - South Sudan") primarily in grass-thatched mud huts (Little). Of this population, 50% lack access to safe water, 10% have access to improved sanitation, and only 1% have access to electricity ("Water, Sanitation and Hygiene (WASH)).

Sudanese households are traditionally multigenerational and large. The average number of children for one family being 5 ("South Sudan - Fertility Rate 2008-2018 | Statista"), and extended families often live with or near each other. Following decades of conflict, many have been left orphaned and are now cared for by extended family networks. ("South Sudanese Culture - Family")

The majority of people live a subsistence lifestyle, where life is often centered around cattle or goat herding or agricultural productions, varying season to season. Due to this subsistence lifestyle, the diet is limited, with staple foods being grains and goat products. This lifestyle has proven problematic thus far, with flooding, violence, poor economic conditions, cereal production, and livestock product shortages, as well as high food prices hindering access to food ("Food Culture and Conflict in South Sudan - the Enough Project"). Due to this, 51% of the population faces food insecurity. Many depend on food assistance to meet their basic needs ("Food Assistance Fact Sheet - South Sudan | Food Assistance | U.S. Agency for International Development").

There are two systems for childhood education, the first being eight years of primary school followed by four years of secondary school, and the alternative being four years of primary school, followed by four years of secondary. Only 50% of school-age children are enrolled in school, and access is even more limited for women. The education sector was significantly disrupted by civil war, and decades of conflict have resulted in many being deprived of quality education. Only 25% of the population can read, with a significant disparity between men and women ("Education of South Sudan | Britannica").

Due to these factors, there is little economic activity outside of agriculture, and farming is a livelihood source for 8 out of 10 households ("How Conflict and Economic Crises Exacerbate Poverty in South Sudan"). This little economic activity, as well as lack of services and infrastructure, results in 82% of South Sudan's population living in poverty, with the median monthly wage being 36500 South Sudanese Pounds, which is approximately 280 US Dollars ("Average Salary in Sudan 2021 - the Complete Guide"). This poverty rate is heightened by hyperinflation within the country, resulting from the pound's rapid depreciation following 2015. Conflict has also disrupted the economy, as did the drop in oil revenues, resulting in the government financing the deficit by borrowing and printing more money, leading to further inflation.

Undoubtedly, South Sudan's food insecurity results from various factors; however, an emerging crisis is a changing climate and the lack of adaptation of farming methods to address climate change's impact on production.

Ranked 7th most vulnerable and the 14th least ready to cope with climate change and its effects (Eckstein), South Sudan has already faced a series of climate-change-related calamities that has resulted in a sharp decrease in crop yields and, subsequently, an increase in food insecurity. Just two years ago, droughts, following widespread flooding, destroyed 73,000 metric tons of ready-to-harvest cereal. While this was devastating, trends regarding cereal production have not improved but rather are worsening. In 2020, the country produced only half of the amount of

cereal required annually ("Hunger Deepening in South Sudan as Floods Follow Drought and Unresolved Conflict | World Food Programme").

South Sudan is in the unfortunate position of being one of the countries that contributes the least to climate change but suffers most from its effects. One of the most rapidly warming countries on the planet, South Sudan has warmed at an average temperature of 0.53 degrees Celsius per decade. This warming has most directly affected the rain patterns in South Sudan, varying from region to region within the country; there has been a 10-20% decrease in "long rains" since the mid-1970s. Since South Sudanese agriculture is based on rain-dependent crops, and long rains have been crucial to their ability to water their crops despite seasonal droughts, the decrease in the rain has exposed rainfall deficits in the northern regions of the country. The regional importance of climate change in South Sudan cannot be underestimated. Simultaneously, while some regions of the country are less affected, others face devastating decreases in their crop yields. The yearly crop yield of sorghum, a product that makes up 77% of South Sudan's annual harvest, will decrease up to 5-25% by 2050, depending on the region that the crop is grown in. ("Evaluation of Foreign Policy Spending")

Trends are not improving; in fact, the impacts of drought currently being experienced in the north and south of the country are expected to begin soon expanding to other regions of the country. As the country's warming continues, the amount of yearly rain will continue to decrease, at a rate of 10-20% less rain per 1 degree celsius increase in temperature (Water Forum).

The extreme weather conditions in South Sudan are a result of human-caused climate change; however, instability, poverty, low literacy rates, and persistent food insecurity have left the country in a particularly vulnerable position ("Confronting Climate Change in South Sudan"). The vulnerability of the country specifically manifests itself in their agricultural habits. The majority of the non-oil economy in South Sudan is dominated by rain-fed agriculture. Thus, as the population has grown and more people have become reliant on unsustainable agriculture, 10% of the population are experiencing seasonal food insecurity ("Overview" | World Bank).

While working to reverse climate change is critical, climate change's current and growing impact necessitates immediate action. In other countries in Africa, a practical approach has been to introduce drought-resistant maize. Therefore, one tangible approach to combating the effects of climate change and drought in South Sudan is the introduction of drought-resistant maize. Based on experience in other African countries, this will require regionalization of the maize and extensive education campaigns that involve local resources to active, successful adoption. Adopting such maize will provide food security as the crops will be more likely to be productive. New maize crops could also offer a pathway to prosperity if enough the crops produce enough excess grain to be sold for profit.

Maize is a staple food in South Sudan, as in many African countries, however by the 2030s, it is expected that drought and rising temperature could decrease the area of suitable maize growing land by 40%; however, the introduction of drought-resistant maize could save the South Sudanese from the impacts of this decrease.

Since 2006, more than 100 varieties of maize have been developed. They have been distributed throughout Africa, including South Sudan, by the Drought Tolerant Maize for Africa Initiative (DTMA). Each variety has been engineered to suit the needs of a particular region specifically. In other countries in Africa, the results thus far have already been beneficial, new varieties have yielded 20-30% more grain than traditional maize, and already 2 million smallholder farmers are growing these new varieties throughout Africa ("Scaling up Season Forecasts")

However, as was seen in Ugandan farms, the availability of technology is not enough to incentivize farmers to grow these new varieties of maize. A lack of education and understanding about the seeds, a fear that the seeds would not meet the farmers' subsistence needs, and a fear of counterfeit seeds, hindered farmers from introducing drought-resistant maize into their crops (Lee).

So while it's clear that the technology for this solution is there, the key to introducing and adopting drought-resistant maize in South Sudan is a centralized, organized, and well-funded distribution and education campaign.

Therefore, my solution is two-fold - a combination of new technology and local education/adoption campaign. This program could be funded by local governments, The World Bank, the Gates and Rockefeller foundations, and USAID, FAO. This project directly addresses the goals of such groups, and these groups have the resources to bring together the groups that should implement a successful project. A successful project will have to partner with organizations already involved and well versed in this issue and used to working locally. From the technology side, scientific groups would include The Alliance for a Green Revolution in Africa (AGRA), International Maize and Wheat Improvement Center (CIMMYT), and International Institute for Tropical Agriculture (IITA), as well as National Agricultural Research Institutes. These groups would have the regional expertise to develop and evaluate maize varieties that are suitable for the South Sudan regions. These groups will also likely have local partners with social science, education, and behavior backgrounds that could help with increasing the adoption of the maize varieties. Further, local Ministries of Agriculture may have a network of agents with contacts at the village level to help with adoption. It is also feasible that other international universities such as Iowa State University could bring resources or helpful expertise, and they could also be partners.

To ensure that South Sudan's needs are met and to empower the villages directly affected by introducing the new maize varieties, a group of local and international experts should speak with FAO to identify the technology needed (Maize) and the education needs. One of the most critical factors I propose as part of the solution is employing a network of people/organizations to deliver this technology to the actual village level. For the successful adoption of new technology, those recommending the maize to local farmers must also be local. A system using village-based advisors to ensure that the farmers are comfortable with those they're working with is needed (Seward ).

Once the technology's distribution and delivery have been addressed, the next and most crucial step is to ensure that the farmers understand the technology and are comfortable using it. Agriculture is generally a conservative sector. Change can be nerve-wracking, particularly when

a farmer is already in a vulnerable economic position, such as occurs in South Sudan, where their crops are already failing. They are already facing seasonal food insecurity. As a result of this, taking the risk of introducing a new crop can be a difficult decision to make. Not only this, but gender inequality is also a potential barrier to widespread adoption and thus needs to be accounted for (Gaya, p81). To combat these barriers, the government must ensure that proper regulation is in place to ensure that the seeds are affordable and available to all farmers and have a system of education to ensure that people know what they're buying and that it is safe to plant and to eat. To do this, an organization like CIMMYT (The Drought Tolerant Maize for Africa Initiative), which has worked with other African nations to introduce drought-resistant maize, should gather a group of farmers with regional similarities to South Sudan, who have already benefited from the introduction of this crop, and have them meet with South Sudanese farmers to discuss the process with them, and quell their concerns. This is not only this, but social scientists and behaviorists from the region should be included in assisting local farmers through their journey of adoption. Village-based advisors will also be the final step in ensuring that the seeds are planted and harvested correctly and adjusting the farming practices of these seeds to fit local village practices.

This project will prove to be self-sustaining and will have more significant impacts outside of just the agricultural sector. As farmers produce higher yields, they will be able to sell their yields and have a higher yearly income, and with that income, be able to purchase more seeds for their future harvests. As this cycle alleviates South Sudan's climate change caused food insecurity, the country will be able to focus its energy less on hunger, but more on conflict resolution, elimination of corruption, and other areas that require change and improvement.

Through these solutions, South Sudan will no longer be a country that requires international aid and foreign charity. South Sudan will no longer remind us of hunger and our own privilege. Instead, South Sudan will become an example of what can be achieved through joint action in empowering farmers to take advantage of new agricultural techniques and integrate them into their daily lives. South Sudan will not only solve its hunger, but it will also become a model to the rest of the world, opening the door for other food-insecure nations to follow in its footsteps and embrace the new technologies the agriculture industry has to offer and inspire further innovation.

## Works Cited:

"Average Salary in Sudan 2021 - the Complete Guide." Salaryexplorer.com, 2021, [www.salaryexplorer.com/salary-survey.php?loc=205&loctype=1](http://www.salaryexplorer.com/salary-survey.php?loc=205&loctype=1). Accessed 26 Mar. 2021.

"Confronting Climate Change in South Sudan." Africa Renewal, 6 July 2017, [www.un.org/africarenewal/news/confronting-climate-change-south-sudan](http://www.un.org/africarenewal/news/confronting-climate-change-south-sudan). Accessed 27 Mar. 2021.

"Education of South Sudan." Encyclopædia Britannica, Encyclopædia Britannica, Inc., [www.britannica.com/place/South-Sudan/Education](http://www.britannica.com/place/South-Sudan/Education).

"Evaluation of Foreign Policy Spending." Government.nl, 2021, [www.government.nl/ministries/ministry-of-foreign-affairs/policy-and-budget/evaluation-of-foreign-policy-spending](http://www.government.nl/ministries/ministry-of-foreign-affairs/policy-and-budget/evaluation-of-foreign-policy-spending). Accessed 27 Mar. 2021.

"Food Assistance Fact Sheet - South Sudan | Food Assistance | U.S. Agency for International Development." Usaid.gov, 31 Mar. 2020, [www.usaid.gov/south-sudan/food-assistance](http://www.usaid.gov/south-sudan/food-assistance). Accessed 27 Mar. 2021.

"Hunger Deepening in South Sudan as Floods Follow Drought and Unresolved Conflict | World Food Programme." Wfp.org, 12 Dec. 2019, [www.wfp.org/stories/hunger-deepening-south-sudan-floods-follow-drought-and-unresolved-conflict](http://www.wfp.org/stories/hunger-deepening-south-sudan-floods-follow-drought-and-unresolved-conflict). Accessed 27 Mar. 2021.

"Overview." World Bank, 2011, [www.worldbank.org/en/country/southsudan/overview](http://www.worldbank.org/en/country/southsudan/overview). Accessed 27 Mar. 2021.

"Rural Population - South Sudan." World Food Bank Open Data [data.worldbank.org/indicator/SP.RUR.TOTL?locations=SS](http://data.worldbank.org/indicator/SP.RUR.TOTL?locations=SS). Accessed 19th March 2021

"Scaling up seasonal forecasts to over 2 million users in Senegal" 2013. CGIAR Research Program on Climate Change, Agriculture and Food Security. <https://ccaafs.cgiar.org/outcomes/scaling-seasonal-forecasts-over-2-million-users-senegal>

"Water, Sanitation and Hygiene (WASH)." UNICEF South Sudan, 19 Mar. 2021, [www.unicef.org/southsudan/what-we-do/wash](http://www.unicef.org/southsudan/what-we-do/wash).

D. Eckstein, V. Künzel, L. Schäfer GLOBAL CLIMATE RISK INDEX 2021 Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2019 and 2000-2019 . [https://reliefweb.int/sites/reliefweb.int/files/resources/Global%20Climate%20Risk%20Index%202021\\_1\\_0.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/Global%20Climate%20Risk%20Index%202021_1_0.pdf)

Gender Differentials and Adoption of Drought Tolerant Maize Varieties among Farmers in Northern Nigeria Gaya, H. I. Tegbaru, A. Bamire, A. S. Abdoulaye T. Kehinde, A. D. European Journal of Business and Management [www.iiste.org](http://www.iiste.org) ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online) Vol.9, No.5, 2017

globalEDGE: Your Source for Global Business Knowledge, International Business College, Board College of Business, Michigan State University. [www.globaledge.msu.edu/countries/south-sudan/government](http://www.globaledge.msu.edu/countries/south-sudan/government). Accessed March 20th 2021.

Honor, Faith. "Food Culture and Conflict in South Sudan." The Enough Project, 8 June 2017, [enoughproject.org/blog/food-culture-and-conflict-south-sudan](http://enoughproject.org/blog/food-culture-and-conflict-south-sudan).

Lee, HyeJin. "Why More Ugandan Farmers Aren't Adopting Drought Tolerant Maize." The Conversation, 2 Sept. 2020, [theconversation.com/why-more-ugandan-farmers-arent-adopting-drought-tolerant-maize-144583](https://theconversation.com/why-more-ugandan-farmers-arent-adopting-drought-tolerant-maize-144583). Accessed 27 Mar. 2021.

Little, Ni C., and K. Kalyoncu. "Architecture Students Explore Housing Solutions for Refugees in Northern Uganda." Over 90% of Houses in South Sudan Are Grass-Thatched, Mud Huts. - COE: Community for Global Health Equity - University at Buffalo, 9 Jan. 2019, [www.buffalo.edu/globalhealthequity/global-projects/refugeehealthandwellbeing/uganda/architecture-students-explore-housing-solutions-for-refugees-in-.host.html/content/shared/www/globalhealthequity/research-and-development/refugee-health-and-well-being-uganda/evaluating-solutions/outlining-the-challenges/over-90--of-houses-in-south-sudan-are-grass-thatched--mud-huts-.detail.html#:~:text=Over%2090%25%20of%20houses%20in,grass%2Dthatched%2C%20mud%20huts](http://www.buffalo.edu/globalhealthequity/global-projects/refugeehealthandwellbeing/uganda/architecture-students-explore-housing-solutions-for-refugees-in-.host.html/content/shared/www/globalhealthequity/research-and-development/refugee-health-and-well-being-uganda/evaluating-solutions/outlining-the-challenges/over-90--of-houses-in-south-sudan-are-grass-thatched--mud-huts-.detail.html#:~:text=Over%2090%25%20of%20houses%20in,grass%2Dthatched%2C%20mud%20huts).

P. Seward and V. Antwi, AGRA impact series: Village-based Advisors assist farmers gain access to last-mile yield-enhancing inputs and extension services <https://agra.org/wp-content/uploads/2020/09/Village-based-Advisors-assist-farmers-gain-access-to-last-mile-yield-enhancing-inputs.pdf>

Pape, Utz, and Arden Finn. "How Conflict and Economic Crises Exacerbate Poverty in South Sudan." World Bank Blogs, 23 Apr. 2019, [blogs.worldbank.org/africacan/how-conflict-and-economic-crises-exacerbate-poverty-in-south-sudan](https://blogs.worldbank.org/africacan/how-conflict-and-economic-crises-exacerbate-poverty-in-south-sudan).

Pier. "South Sudanese Culture - Family." Cultural Atlas, [culturalatlas.sbs.com.au/south-sudanese-culture/south-sudanese-culture-family](http://culturalatlas.sbs.com.au/south-sudanese-culture/south-sudanese-culture-family).

Plecher, Published by H., and Nov 3. "South Sudan - Fertility Rate 2008-2018." Statista, 3 Nov. 2020, [www.statista.com/statistics/727366/fertility-rate-in-south-sudan/](https://www.statista.com/statistics/727366/fertility-rate-in-south-sudan/).

Simoes, AJG, CA Hidalgo. The Economic Complexity Observatory: An Analytical Tool for Understanding the Dynamics of Economic Development. Workshops at the Twenty-Fifth AAAI Conference on Artificial Intelligence. (2011) [oec.world/en/profile/country/ssd#:~:text=Exports%3A%20The%20top%20exports%20of,and%20Uganda%20\(%243.19M](https://oec.world/en/profile/country/ssd#:~:text=Exports%3A%20The%20top%20exports%20of,and%20Uganda%20(%243.19M). Accessed on March 19th 2021

South Sudan Infrastructure Action Plan - a Program for Sustained Strong Economic Growth - Chapter 6 - Development of Agriculture in South Sudan. African Development Bank (AfDB) Group, 2013

The Drought Tolerant Maize for Africa Initiative - Background.". "CIMMYT - IITA .: Cimmyt.org, 2011, [dtma.cimmyt.org/index.php/about/background](http://dtma.cimmyt.org/index.php/about/background). Accessed 28 Mar. 2021.

The World Factbook 2021. Washington, DC: Central Intelligence Agency, 2021. [www.cia.gov/the-world-factbook/](https://www.cia.gov/the-world-factbook/) Accessed March 20th 2021.

Water Forum, World. Vulnerability of Arid and Semi-Arid Regions to Climate Change - Impacts and Adaptive Strategies Perspectives on Water and Climate Change Adaptation.