

Charles Mahoney  
Culver Academies  
Culver, IN  
Tanzania, Factor 5: Climate Volatility

## **Addressing Agricultural Output in Tanzania in the Face of Climate Volatility**

### **Background**

Tanzania is an east African country bordering Kenya, Mozambique, and the Indian Ocean. Formerly a colony of Great Britain, the country gained independence in 1961 and currently runs as a presidential constitutional republic (CIA World Factbook). The country's official languages are Swahili and English, but Tanzania supports a plethora of linguistic, cultural, and religious diversity within its borders. Demographically, Tanzania has simultaneously the largest population and the lowest population density, in east Africa. Of the country's 51 million inhabitants, two-thirds of the population live in rural areas, and about one-third live below the poverty line (CIA World Factbook). The average family size clocks in around five people, with a high fertility rate of 4.8 children per woman (UNFPA). Tanzania ranks only 151 out of 188 on the Human Development Index, and the quality of life for the average citizen leaves much to be desired (World Food Programme). The country spends only about 3.5% of GDP on education, and with an expected educational lifespan of 8 years, very few people go on to university (CIA World Factbook). The country is currently struggling against HIV and Malaria, which are respectively the number one causes of death for adults and children under five. (CIA World Factbook). But with only 0.03 physicians for every 1,000 people, reducing the transmission and treating these diseases is an uphill battle (CIA World Factbook). Of all of these issues in Tanzania that desperately need to be addressed, none are more pressing than the increasing risk posed by climate volatility to the countries already strained food production, which is so important for providing the basis for addressing all the other challenges.

### **Problem**

Throughout much of its modern history Tanzania has been battling the scourge of an under fed people. The UNDP has stated that the amount of malnutrition and extreme hunger in Tanzania is "alarming", and progress towards alleviating these crises has been slow (UNDP). Stunting currently affects 42 per cent of children under five, and nearly two fifths of women 15-49 years old are anemic (UNICEF). Increasingly, the shifting world climate has begun to raise concerns that Tanzania's agricultural output is under threat, exacerbating the aforementioned problems. In a paper written by Syud Amer Ahmed, a researcher from the World Bank, from 1971 to 2003 average temperature in the January-June growing period increased by about one degree Celsius, with two additional degrees of change projected by 2031 (Ahmed). A corollary trend plotted during this time indicated yields of maize, grains, and sorghum both increased in their volatility and decreased in their average yield. Maize, the principle food crop of Tanzania, has gone from a high of 1.7 tons/ha in 1971 to a low of 1.2 tons/ha in 2001, and estimates show yields dropping to less than 1 ton/ha by 2031 (Ahmed). The re-percussions of this decline in crop yields would shake both the Tanzanian food supply and the Tanzanian economy. In Tanzania, agriculture provides more than a quarter of the national GDP, accounts for 85 percent of exports, and employs 80 percent of the workforce (Yield Gap). This dependence on agriculture for feeding its people and as a principle industry means a decline in crop yields would leave everyday Tanzanian farmers with both empty bellies and empty wallets. Their vulnerability to such an event is compounded by the fact that much of their agricultural output is from small, inefficient farms that do not utilize any form of modern irrigation or agricultural techniques, and do not have access to an effective post-harvest transportation infrastructure. As these climatic pressures continue, such an unproductive food supply will not be able to keep up with a population that grows about 3% each year (UNFPA). Climate volatility is, at least for the near future not going to slow down or go away. Regardless of what environmental protections we may advocate for in the next few years, the reality is that too much damage has already been done; we have to face this inevitable future honestly, if we hope to mitigate further challenges. Tanzania's agricultural sector as is cannot provide enough food to

feed its current population, and it is unprepared to deal with the increasingly drastic effects of a changing climate.

### **Understanding the roles of Stakeholders**

When addressing this problem we have to realize that any solution must be framed in terms that enable the majority shareholders of Tanzania's agricultural production: small rural farmers. Individual farmers, not large corporate plantations, are the keys to solving the inefficiency of Tanzanian agricultural production. Enabling farmers to pursue their own agricultural advancement and fiscal independence is the only way to effectively fight both hunger and poverty at the root level. This being said it is not as if large entities such as corporations, nonprofits, and government organizations have no role to play. They all play a large role in making sure that the purposed solutions are economically viable and can be put into place across the country. It is also important to realize that there is not a miracle cure for a problem this complex; we must analyze how many different solutions can work in concert to address the problem. With this in mind, there are three different methods that, if used in concert with one another, may hold the key to sustainable food production: an increase in the use of rice as a principle food crop through SRI farming, basic irrigation infrastructure, and fiscally enabling Tanzanian agricultural shareholders, both large and small, to produce at an optimal efficiency.

### **Part I- Why Rice?**

So why increase rice production? In the aforementioned paper by Syud Amer Ahmed, despite the increasing climate volatility, rice yields are increasing and even surpassing sorghum, grain, and maize in tons per hectare as the century continues. Rice yields have shot up from .5 tons/ha in 1971 to 1.7 tons/ha in 2001, and are predicted to reach nearly 3 tons/ha by 2031 (Ahmed). This rise in yield, compared to its competitors, makes rice a very attractive choice for farmers. So how can we effectively promote this change amongst the average Tanzania farmer? The answer may lie in SRI farming practices, as they are both easy to learn, and require very little startup cost.

### **SRI- The Basics**

The four principles of SRI or "System of Rice Intensification" are quick and healthy plant establishment, decreased plant density, enriched soil quality through organic matter, and reduced water application. The basic methodology involves transplanting single seedlings into organically enriched soil at 8-12 days into uniform 25cm square patterns. The soil is kept wet, but is not flooded. A layer of 1-2 cm of water is introduced to the paddy, allowed to dry until cracks form in the earth, and is then reapplied (SRI "Resource Center").

### **SRI-Benefits**

Providing more space for each rice plant and a corresponding lack of competition allows each plant to develop its own stronger root system, allowing for stronger and healthier plants—in fact, this robust root development reduces plant lodging (the collapse of the plant under its own weight) by 10 to 55 percent (SRI "Climate Smart"). In addition, this technique actually lessens the amount of greenhouse gases released into the environment, due to the fact that the rice paddies not being completely flooded. The soil exists in a more aerobic state (meaning oxygen is present), which reduces the production of methane by 22 to 64 percent (SRI "Climate Smart"). This is huge as it fundamentally combats the vicious cycle of climate volatility affecting crop production, a cycle that ultimately results in farmers consequently needing to grow more greenhouse gas-producing crops to compensate. This decrease in flooding also reduces the needed quantity of water per hectare by 30 to 50 percent (SRI "Climate Smart"). This all culminates in SRI increasing labor productivity and decreasing production cost. The more efficient use of water and land significantly decreases the need for vast water reserves and financial investments on the part of the farmer. The startup capital needed is lowered even further by the fact that this system does not necessitate the use of modern machinery or expensive seed, meaning farmers can learn this with just the

skillset they already possess. In a summary published by Cornell University's College of Agriculture and Life Sciences, rice yields of small farms within 50km of KPL (a company supporting SRI method adoption in Tanzania) had tripled their average production within a few years of KPL's introduction (SRI "Tanzania").

## **Part II- Irrigation Infrastructure**

The aforementioned reduction in water usage is extremely significant, as currently Tanzania's water consumption is highly inefficient. Seventy-one percent of rice cultivation in Tanzania is rain fed and does not utilize basic irrigation techniques, such as drip irrigation, water tanks, or irrigation pumps (SRI "Tanzania"). Despite their small size, and cost, these irrigation methods have been extremely successful in the few places they have been implemented. Recently, the World Bank reported on the village of Magozi, where assistance from the International Development Agency had allowed farmers to increase cultivatable land from 650 ha to 1,500 ha and yields from 2,600 tons of rice to 8,250 tons in just three years. Similar projects have plenty of room to expand, as currently only 23 percent of Tanzania's arable land is in use (Yield Gap). Various projects have been financed by the International Development Association, with support from various other organizations, in hopes of improving Tanzania's national irrigation use. As a result, the total area of land under improved irrigation infrastructure has increased by 51%, from 264,388 ha in 2006 to 399,775 ha in 2012 (World Bank). The Millennium Challenge Compact also aims to provide Tanzania 66 million USD to fund water projects in Tanzania, allowing for even more irrigation. (Oxford Business Group). This funding, and the funding of other international organizations, could provide the support needed to scale up these projects, giving small farm holders a way to establish their own economic and agricultural independence.

## **Part III- What can large organizations do?**

Now that we have identified how to increase the efficiency of the farming itself, the question now becomes: what can companies, non-profits, and government organizations do to encourage agricultural growth on a larger scale? In order for any of the solutions to work, they need to be economically viable. Therefore, these organizations should aim to reduce credit risk taken on by farmers hoping to expand their production and improve Tanzania's post-harvest infrastructure.

### **Low Interest Capital**

Farmers need access to low interest loans as a means of investing capital into their small business or farm. Without this ability to borrow low interest capital, farmers may forgo expanding, fearing they may become caught in a crop lean debt cycle. Luckily, there are already projects in development that hope to satisfy this need. The Tanzanian Agricultural Development Bank or TADB, created in 2015, aims to provide low interest loans to 1 million farmers over the next five- year period with help from a 91 million dollar loan from African Development Bank (Oxford Business Group). In addition, PASS, a local non-banking financial institution, aims to provide \$51.4 million in low interest loans to nearly 400,000 small entrepreneurs (Oxford Business Group).

### **Post-Harvest Infrastructure**

Steps should also be taken to increase Tanzanian transportation and agricultural infrastructure to further enable large stakeholders in Tanzanian crop production. In report on Tanzania's agriculture sector, Denise Wolter likens Tanzania's agricultural market to a sleeping giant. The country has the ability to produce enough food to be a major exporter, but due to the lack of infrastructure necessary for the market to function, has to import food to feed itself. According to government data, 42 percent of produce is lost in storage to pests, and some businesses are moving their shipping from Dar es Salaam (through which 70 percent of trade is conducted) to Mombasa, Kenya, to avoid bureaucratic barriers and speed transit (Oxford Business Group). Currently the government is taking steps to remedy these problems, and modernize Tanzanian transportation infrastructure. The Ministry of Agriculture, Livestock, and Fisheries

Development is already beginning an infrastructure modernization drive, hoping to secure up to \$676.5 m from the National Micro Finance Bank, and Commercial Bank of Africa (Oxford Business Group). Already similar efforts to boost downstream processing have borne fruit by raising value-added net value by 61% from 2009 to a 2014 total of \$13.8bn (Oxford Business Group).

## Conclusion

Over the last couple of decades, Tanzania has made considerable progress in addressing the ailments of the country. Yet much work remains to be done. We cannot allow climate volatility to reverse this course, and take the Tanzanian people back into 20<sup>th</sup> century levels of poverty, and hunger. The implementation of SRI farming, basic irrigation techniques, and an improved post-harvest infrastructure in concert with one another could help address Tanzania's fundamental issues in farming efficiency and post-harvest infrastructure. In doing so, together they safeguard both the Tanzanian food supply and economy from a significant decline. Our only option in the face of this inevitable challenge is a proactive drive to implement these solutions before the people of Tanzania begin to suffer the wrath of a volatile climate.

## Works Cited

- "About Tanzania." *United Nations Development Programme*, [www.tz.undp.org/content/tanzania/en/home/countryinfo.html](http://www.tz.undp.org/content/tanzania/en/home/countryinfo.html). Accessed 19 May 2016.
- Ahmed, Syud Amer, et al. "CLIMATE VOLATILITY AND POVERTY VULNERABILITY IN TANZANIA." Agricultural & Applied Economics Association, 26 July 2009, Milwaukee, Wisconsin. <http://ageconsearch.umn.edu>, [ageconsearch.umn.edu/bitstream/49358/2/Ahmed\\_conference09.pdf](http://ageconsearch.umn.edu/bitstream/49358/2/Ahmed_conference09.pdf). Accessed 22 Mar. 2017.
- "Nutrition." *UNICEF Worldwide*, [www.unicef.org/tanzania/nutrition.html](http://www.unicef.org/tanzania/nutrition.html). Accessed 12 Mar. 2017.
- Oxford Business Group. "Stronger support for Tanzania's farmers." *Oxford Business Group*, 7 Feb. 2017, [www.oxfordbusinessgroup.com/news/stronger-support-tanzania%E2%80%99s-farmers-0](http://www.oxfordbusinessgroup.com/news/stronger-support-tanzania%E2%80%99s-farmers-0). Accessed 10 Mar. 2017.
- "SRI International Network and Resources Center." *The System of Rice Intensification*, Cornell College of Agricultural Sciences, [sri.ciifad.cornell.edu/](http://sri.ciifad.cornell.edu/). Accessed 4 Mar. 2017.
- The System of Rice Intensification (SRI) is climate-smart rice production*. Cornell University, 2014. <http://sri.ciifad.cornell.edu>, [sri.ciifad.cornell.edu/conferences/IRC2014/booth/SRI\\_climate\\_smart\\_rice\\_production\\_%20handout\\_2014.pdf](http://sri.ciifad.cornell.edu/conferences/IRC2014/booth/SRI_climate_smart_rice_production_%20handout_2014.pdf). Accessed 15 Mar. 2017.
- "Tanzania." *The System of Rice Intensification*, Cornell University College of Agricultural Sciences, [sri.cals.cornell.edu/countries/tanzania/index.html](http://sri.cals.cornell.edu/countries/tanzania/index.html). Accessed 15 May 2016.
- "Tanzania - Global Yield Gap Atlas." *Global Yield Gap Atlas*, University of Nebraska Lincoln, [www.yieldgap.org/tanzania](http://www.yieldgap.org/tanzania). Accessed 16 May 2016.
- "10 Facts About Hunger In Tanzania." *UN World Food Programme*, 13 May 2016, [www.wfp.org/stories/10-facts-about-hunger-tanzania](http://www.wfp.org/stories/10-facts-about-hunger-tanzania). Accessed 25 Nov. 2016.
- UNFPA. "More people move to urban areas as Tanzanian population gallops." *UNFPA Tanzania*, 19 Apr. 2013, [tanzania.unfpa.org/news/more-people-move-urban-areas-tanzanian-population-gallops-0](http://tanzania.unfpa.org/news/more-people-move-urban-areas-tanzanian-population-gallops-0). Accessed 8 Feb. 2017.

- Wolter, Denise. "Tanzania – Why a Potential Food Exporter is Still Importing Food." *OECD*, [www.oecd.org/countries/tanzania/41302291.pdf](http://www.oecd.org/countries/tanzania/41302291.pdf). Accessed 15 Mar. 2017.
- World Bank. "Irrigation Development Helps Tanzanian Farmers Thrive." *The World Bank*, 30 Aug. 2013, [www.worldbank.org/en/news/feature/2013/08/30/irrigation-development-helps-tanzanian-farmers-thrive](http://www.worldbank.org/en/news/feature/2013/08/30/irrigation-development-helps-tanzanian-farmers-thrive). Accessed 25 May 2016.
- World Bank. "New Project to Link Farmers to Agribusiness in Tanzania." *The World Bank*, [www.worldbank.org/en/news/press-release/2016/03/10/new-project-to-link-farmers-to-agribusiness-in-tanzania](http://www.worldbank.org/en/news/press-release/2016/03/10/new-project-to-link-farmers-to-agribusiness-in-tanzania). Accessed 21 May 2016.
- "The World Factbook: TANZANIA." *Central Intelligence Agency*, 17 Jan. 2017, [www.cia.gov/library/publications/the-world-factbook/geos/tz.html](http://www.cia.gov/library/publications/the-world-factbook/geos/tz.html). Accessed 22 Jan. 2017.