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Nigeria, Climate Volatility

Nigeria: Revitalizing the Agricultural Sector

The global climate is currently shifting faster than it has at any point in the past 2,000 years, according to publications in the journals *Nature and Nature Geoscience* (Letzter 2019). The world will have to adjust to a climate that is changing every year, month and day. Agricultural economies, such as the country of Nigeria, need to find a solution to this problem in order to avoid adversely affecting people today and future generations to come.

Nigeria is one of the most populated countries in the world, with approximately 206,405,000 people. Around 52 percent of the population is urban, compared to roughly 80 percent of the U.S. population living in urban areas ("Nigeria Population [LIVE]"). Nigeria is a federal republic with three branches of government - legislative, executive, and judicial. Muhammadu Buhari is the current president of Nigeria and was re-elected recently in 2019. His main concerns during this term of his presidency are education and farmer-herder clashes, as well as climate change.

Agriculture is an essential part of Nigeria's economy, with the sector employing around 36 percent of the entire country's labor force ("Nigeria - Employment in Agriculture"). Around 37 percent of Nigeria's land was considered arable in 2016 ("Nigeria - Arable Land"). The main agricultural products in Nigeria are rice, cassava, ginger, cocoa butter, and nuts. Nigeria used to be one of the world's largest exporters of palm oil, but lost that title over the years to Indonesia (Admin et al. 2018). A majority of Nigeria's exports are not environmentally friendly, such as mineral fuels, which made up about 87 percent of the country's exports in 2019 (Workman 2020).

Nigeria has a wide range of climates, varying from arid in the north to humid in the south, with it becoming more rainy the farther south someone travels. Nigeria is bordered by the countries of Niger, Chad, Cameroon, and Benin. To its south, there is the Gulf of Guinea of the Atlantic Ocean. Nigeria has plains in the north and in the south, but plateaus and hills in the central area of the country. The Niger River and the Benue River are the primary rivers in Nigeria (Ajayi, Udo, Kirk-Greene, & Falola 2020).

The typical family size in Nigeria is five people. About half of Nigerians live in households with cement flooring, compared to sand and dirt traditionally used in lower class homes. There is an average of 3.3 people per sleeping room in this country ("Household Population and Housing Characteristics"). Those employed in the agricultural sector made an average of 9,815 USD in the year of 2013. Around 88 percent of farmers operate on small family farms, which causes larger fluctuations in their salary from year to year than there would be at more expansive farms ("Small Family Farms Country Factsheet").

Nigerians' diets include a high amount of rice, their staple food, as well as some local produce. Nigeria's rice production has increased in recent years. In President Muhammadu Buhari's first term, he banned the import of multiple items including rice, causing a rise in food prices. This caused some Nigerians to begin to smuggle these foreign imports across the border. Lately, Nigerians have been consuming a higher percentage of meat than before. Nigeria accounts for half of all of West Africa's beef consumption, which is predicted to quadruple by 2050 ("Hunger for Beef Offers Rewards and Risks for Nigeria's Pastoralists"). Africa has worsening food security due to factors including climate change, declining

agricultural productivity, and a quickly growing population. African Union member states are committed to ending hunger by 2025 and ensuring resilience to climate-related risks. Nigeria is extremely behind in achieving both of these goals.

For sub-Saharan Africa, which includes Nigeria, the effects of higher temperatures (more than 1.5 degrees Celsius) will have a major impact. Temperature increases in this region are predicted to surpass the global mean temperature increase. West Africa is a climate-change hub, which will eventually cause a reduction in crop yields and production; this will lead to a rise in food insecure nations. The Sahel, an area that includes Nigeria, is one of the most affected regions in the world. It has a rapid population growth in an area with diminishing natural resources. This problem has caused conflict between herders and farmers, and weak leadership has caused social disintegration.

In northeast Nigeria, there is a high percentage of food insecurity. The region is in crisis and in a state of emergency with the issue worsening. This is due to both climate change and Boko Haram, with climate change spurring this terrorist organization in northeast Nigeria. Although the rest of the country is currently facing acute food insecurity, it is guaranteed to worsen in the near future, with there being virtually zero preventative measures to combat climate change's impact on agricultural practices.

Climate change will have a substantial impact on Nigerian families' livelihoods. As already stated, over 36 percent of Nigeria's population work in the agricultural field. Agricultural produce in this country is mainly rain-fed, meaning that the unpredictable rainfalls due to climate change makes it difficult for farmers to produce a lot of crops. Without a plethora of agricultural produce harvested, this increases the risk of severe food insecurity in Nigeria, a country who is trying to become more economically independent by producing their own food.

This issue has monumental consequences across many fronts not already mentioned. Climate change will have an impact on gender roles. A large percentage of women in Nigeria are farmers who rely on rain-fed crops. A disturbance in these agricultural operations will threaten their livelihoods, making them more dependent on men ("Why Climate Change Disproportionately Affects Women"). Climate change will also affect further advances in Nigeria's gross domestic product, children's ability to get an education, and national security.

Nigeria has taken steps in response to climate change. In 2017, Nigeria ratified the Paris Agreement. Their Nationally Determined Contributions made under the Paris Agreement contain Nigeria's efforts to adapt and combat climate change, with the country planning on reducing their emissions by 50 percent. The president created a seven-point plan to fight against climate change, with it essentially restating the Paris Agreement's goals.

Although Nigeria addressed these climate change related problems, they have not actually taken the steps needed to reduce the effects of climate change at the rate promised. Nigeria is far off from reaching their climate change related goals. They still heavily rely on oil for revenue, which puts large amounts of carbon into the atmosphere. Their reforestation efforts are weak considering how much land was destroyed within the last century. Overall, Nigeria has ambitious goals, but they are not effectively carrying out their plans in response to this global emergency.

Nigeria must find a way to make their agricultural practices climate resilient that is both effective and beneficial for their economy. They need to implement new policies and goals as well as encourage

innovative technology in their agricultural sector. These steps will reduce their food insecurity and lessen their reliability on the natural environment.

The Nigerian government needs to consider implementing a policy that makes loans readily available to farmers who want to use technology based farming systems, such as installing an irrigation system. They could create long-term loans with low interest. This will allow farmers, who usually make less money than other occupations, the opportunity to implement technology like irrigation systems. This technology will make their land more resilient to climate change, since it would allow them to water their crops if there is, for example, a drier farming season than usual.

In the past, Nigeria has financed citizens directly instead of going through Nigerian banks, which was proven to be successful a few years ago. Because of this, the Nigerian government should subsidize these irrigation systems directly, as well. As of now, the Nigerian government relies mainly on revenue from oil instead of tax revenue for government spending, which is unsustainable and unreliable. In 2018, 19 million Nigerians paid state and federal taxes, which is less than 30 percent of the population ("Nigeria: Why is it struggling to meet its tax targets?"). If the government were to increase the number of taxpayers by a small percentage, such as a five percent increase in taxpayers, this money could be put back into the communities through installing irrigation systems. The government could also reallocate a small amount of their funds, which includes money from foreign aid, towards the microloans instead of increasing the number of taxpayers. Historically, Nigeria has been known to spend money on building new golf courses and pools instead of repairing roads and supplying water to neighborhoods. If they were to cut funding from these more frivolous programs, these resources could be used towards financing the irrigation systems.

Nonprofit organizations could also help subsidize the irrigation systems if the government is not willing. There are many organizations and businesses that give microloans to people from developing countries, such as the Global Giving organization; some of these groups are primarily focused on giving microloans to Ghanaian women, which could pose a small problem if they do not have the resources to also finance Nigerian farmers. A non-government organization could be better equipped to give out loans, since the Nigerian government has been corrupted in the past. Although, differences in religion, ethnicity, and culture could create problems of violence between the two groups.

Some advantages to putting this policy into action is that farmers would be able to increase their yields significantly, which would increase Nigeria's exports and decrease their dependency on importing goods from other countries. Another advantage is that the growing season will extend, and farmers will be able to grow crops into the dry season. A majority of Nigerians cannot do this now, since a large number of farmers have rain-fed crops. Irrigation systems would also make agricultural practices less dependable on the climate and weather, therefore making it more climate resilient. These systems do not have to involve advanced technology, which would be inappropriate for Nigeria and their government funds, and they can be cost-effective.

Some disadvantages to this idea is that implementing a policy like this is a risk to the government. If farmers could not pay the loan off, they could lose their new equipment and possibly their land, which could drastically affect Nigeria's economy. Another disadvantage is that some irrigation systems could deplete Nigeria's water resources and cause water scarcity in areas throughout the country, although this could be prevented if Nigeria were to only supply, for example, drip irrigation systems; these irrigation systems are affordable and water efficient.

Another possible solution is for nonprofit groups to encourage and educate the people on aeroponics. Aeroponics is a process used to grow crops without using soil, which is done by suspending the roots in the air. In an aeroponic farming system, plants are nourished through repeated spraying with a solution containing water as well as other nutrients (Philipp 2019). This system has been implemented on a large scale in places such as New Jersey. Their aeroponics farm is the largest in the world, where the plants are grown without sunlight, water, and soil (Malavika Vyawahare in Newark 2016). The Borgen Project, a U.S. based nonprofit group that fights poverty in developing countries through civic engagement and education (Thelwell, Borgen, & Yamaguchi 2019), would be one civic group that could send educators to help farmers create these agricultural systems; this organization is a large supporter of aeroponics, which makes them more suitable to lead this than other nonprofit groups. These educators could travel from town to town, with the knowledge of a Nigerian group or government leader, and perform live demonstrations on how to set up an aeroponic system. Most of the nonprofit organizations based in Nigeria are focused on empowerment and fighting for human rights, so a foreign NPO like this would be better suited to lead the project, although other nonprofit groups could help implement this in towns and cities. This idea could also be approached more euphemistically, and nonprofit groups could instead seek out Nigerian agricultural science professors and teachers to educate locals, which would be less invasive and could possibly be more effective. This plan would require no funding on the Nigerian government's part, with it being funded by donations to The Borgen Project. Nonprofit groups would have to consider Nigerian cultural norms, such as Nigeria's gender inequality and the possibility of Nigerian men refusing to listen to a foreign woman trying to teach aeroponics. They would also have to be conscious of hostilities between Christians and Muslims in the nation.

Advantages to implementing this idea is that aeroponics would require virtually zero dependence on the environment or weather. This idea is eco-friendly and sustainable, with it involving very small amounts of water. This would address Nigeria's land shortage and desertification problems, and is also extremely cost friendly. This type of farming system can also be implemented on a large scale. Disadvantages to implementing this idea is this method of farming can only produce certain plants and can not grow things like tomatoes or cucumbers. If this method of farming eventually becomes widespread, Nigeria would have a lack of crop diversity and it would be difficult for them to export their crops to other nations.

It is imperative that, in addition to this two-step solution, Nigeria also continues preventative measures for climate change. The government needs to adhere to the guidelines laid out in the Paris Agreement, making sure to keep the goal of a carbon neutral country in mind with every decision they make. They need to have more aggressive reforestation efforts, and should allocate more funds towards this. The Nigerian government also needs to become less dependent on oil by producing more crops and other materials to export. They should also consider creating a policy that preserves Nigeria's water sources and their soil from pollutants.

Citizens of Nigeria can encourage this plan by petitioning the government to implement this plan through peaceful protests and communicating with local leaders. Foreign governments could put economic pressure on Nigeria to carry out their climate change agreements, since Nigeria is dependent on foreign food sources.

Therefore, due to the implications climate change will have on Nigeria and its food security, the Nigerian government needs to consider creating this microloan policy, and nonprofit groups need to help encourage innovative farming technologies. This long-term, low interest loan policy will positively benefit the Nigerian government. They will have a more dependable source of food for the Nigerian people, and the larger crop yields will increase the number of exports and decrease the number of imports. This

improvement in the GDP will come to benefit Nigeria's economy. This policy will also benefit farmers. Farmers will become less dependent on the rain and environment to nourish their crops, and have a more dependable source of income. With the irrigation system, farmers' crop yields will cost less money to produce per acre, which will also create a larger income for them if they sell at the same price as before; farmers can use this additional money to expand their operations. Nonprofit groups need to consider collaborating with the Nigerian government and people to educate locals on aeroponics. This farming technique will make Nigeria's agricultural sector resilient to climate change and address the issue of land shortage. This will benefit farmers by allowing them to produce crops year round, which will in turn benefit the economy. This idea can also reduce the number of poverty-stricken people in Nigeria by giving them the opportunity to create a living for themselves without having to buy large amounts of land or invest in expensive equipment. In addition, the Nigerian government needs to take preventive measures, including reforestation efforts and reducing their dependency on oil to slow the rate of climate change. By repairing the damage already done, creating a plan to protect food sources as well as the economy, and doing everything they can to prevent climate change, Nigeria will be creating a hopeful, food-secure future for their nation.

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