

Sophia Xiao
Pleasant Valley High School
Bettendorf, IA
Senegal, Factor 5: Climate Volatility

Connecting the Farms: The Combat Against Senegal's Climate Volatility

As a country with one of the fastest growing economies in West Africa, Senegal depends upon its agriculture to sustain its people. Senegal's highly productive 2015 season can be partially attributed to good rainfall and strong production of the country's staples such as groundnuts and rice (*The World Bank*). Climate volatility is a major determining factor in the agricultural and economic success of Senegal, one of the world's more underdeveloped countries with a poverty percentage of about 47 percent. As poverty and food insecurity are closely joined factors, 50 percent of the Senegalese population is food insecure, making its weakened status an urgent matter (*World Food Programme*). Agriculture is very susceptible to climate changes, which has become more and more of an issue with recognizable trends starting in the 1950s. The temperature in the country has increased dramatically over the last 50 years: in the northern areas by 3°C and the national annual average by 1.6 °C. Rainfall has had inverse trends with a 30% reduction over the same period, and moreover, the location and time period in which this increase has occurred have shown to be greatly inconsistent (Sabelli). The threat of increasing climate volatility suggests a bleak future for the agricultural industry and food security of the Senegalese people. Only through the adoption of long-term, sustainable solutions for agricultural, economic, and local practices can the severity of the situation be lessened.

When comparing its GDP (13,610 million US dollars) to other countries, Senegal ranks 119th out of the 195 countries in the world ("GDP Ranking"). A typical family income is only \$2.80 per day (The World Bank Group). As an underdeveloped country, the majority of Senegal's workforce is uneducated and works in labor. According to the 2010-11 Senegal DHS-MICS, 38% of women and 60% of men are literate and only a shocking 3% of women and 6% of men who are ages 15-49 have completed their secondary education or a higher degree (*Demographic and Health Survey*). 22% of children ages 5 to 14 work. Healthcare access is low with one physician available for every 17,000 people, and the Senegalese run a very high risk risk of developing one of the major diseases, such as malaria, meningitis, dengue fever, and typhoid ("The World Factbook"). The average household size in Senegal is approximately 9 to 10 people, according to a survey done in 2012 ("Ranking by average household size"). The culture encourages large families - though women prefer 5.2 children compared to 7.3 children preferred by men - and almost half of the typical household is under the age of 15. Childbearing starts early: one in five young women ages 15-19 has already begun, according to a survey done in 2010-11. In addition, there is a culture of polygamy as 35% of women are married to a man with multiple wives, which increases the household size, making it difficult in more rural families to provide adequate food to all (*Demographic and Health Survey*). Meals commonly consist of rice - or other cereals such as millet or sorghum, with groundnut and cowpea and even vegetables and fish if available. With the country's increase in urbanization and imports, rice has increased in prevalence in consumption. As the Food and Agriculture Organization of the United Nations (FAO) states in a profile on Senegal, "difficulties in the agricultural sector combined with poverty are the main causes of household food insecurity" ("Nutrition Country Profiles"). The country's dependence upon the agricultural sector stems from the fact that most households, rural or urban, buy their food (87 and 97 percent respectively). Only 10 percent of consumed food is self-produced in rural households. Therefore, price fluctuations due to climate-affected crops severely impact food security around the country (*Climate Risk and Food Security*).

The income received from agricultural production is essential to a rural family in Senegal. 70% of workers are involved in farming, but farms are typically about 3.7 to 5.9 acres, which is relatively small. Staples produced by Senegal include groundnuts (peanuts), millet, sorghum, cotton, and rice. A majority of the farms (60%) can be found in the groundnut basin, a predominant area for growing cash crops. However, the basin is extremely sensitive to changes in the climate such as drought, so good rainfall is key to agricultural productivity. One of the biggest struggles with increasing or at least stabilizing production is making water available to the crops. Only 5% of the country's land is irrigated, making farmers dependent on rain to keep their crops flourishing (*Worldmark Encyclopedia of Nations*). The climate variability means not only could there be droughts but floods as well; both of which can cause soil erosion, decreasing the current year's yield as well as those in future years. The Senegalese government is continually making attempts to solve this problem. Two dams, the Manantali and Diama, were built almost forty years ago in the 1980s to maintain or store extra water depending on whether the season was wet or dry ("Country Profile - Senegal"). With this reservoir of water, farmers would be able to double crop or plant an extra crop between the two main growing seasons ("Fertilizer Use by Crop"). The dams, instead, reduced productivity through their ineffective flood-recession methods. Ongoing projects done by various organizations are trying new methods that show promising outcomes ("Country Profile - Senegal").

Senegal faces many different barriers to improve its agricultural productivity and economy as a whole. Although progress is being made in the form of political action, there are sectors that are undervalued. An issue that is currently being dealt with by the government through the National Land Tenure Law of 1964 is the implementation of a widespread system to give administrative divisions rather than the heads of tribes the right to manage the land, facilitating the overseeing of farmers and movement of exports. Giving the government the power to manage the land unifies the farmers, and if there is need of financial support in a bad season, it can be provided more easily. Although there are effective plans in place, there should be continuous dialogue about adjustments made to policies both in the field and in management for agricultural productivity to increase. It is, after all, a sector encompassing many different areas of study. A lack of proper infrastructure in rural areas is another major barrier to economic growth in Senegal. Due to the extreme variance in the country's topography, it is difficult to set up any permanent roads, transportation, energy, or systems of communication. Farmers in rural areas find it difficult to receive the equipment they need for large scale farming or for transporting crops to markets that may be a long distance away. The twenty or thirty mile walk may be impossible to complete by an individual walking with a burden in Senegal's hot climate, and the product itself may have spoiled by the time the destination is reached. Farmers are unable to receive equipment, such as plows or irrigation tools, that is necessary to farm certain parts of the land that are arid. Families struggle to receive the nutrition they need because access to food markets is difficult. As the rainfall variability increases, so does the price of food, with negative impact on the types of food that farmers are able to buy for their households. About one out of five households eat less than the average of three meals per day during the lean seasons and many continue to do so even after the season has passed (*Climate Risk and Food Security*). This, in turn, negatively affects farmers' work ethic, making them helpless victims of climate volatility. In addition, since these farmers have limited access to means of communication, a barrier is formed between them and the outside world, preventing the spread of information even from their own government. In such a rural setting, without tracking down each and every farm, it is quite difficult to educate the entire population. Finally, there may also be issues with trying to communicate solutions or climate sustainability information because of the lack of education found throughout Senegal. Without efficient means to connect to a larger market, farmers become isolated and struggle to better their lives or even to just sustain themselves financially.

These struggles for families are often-day-to-day. Unable to save either money or product when the rainfall fluctuates, farm holders are at a loss for what they can do. Another major barrier to agricultural productivity is created by these farmers themselves through erosion and deforestation. Farmers cut down trees to expand their land in order to plant more crops in hopes for a better harvest, but they are removing a source of shade for their crops which will quickly wilt in direct heat. Tree roots also prevent sediment runoff by holding the soil, preventing the water from washing it away and slowing down the rate of water flow so it may be absorbed into the ground. Farmers should be educated on effective and sustainable agricultural practices. Most of the Senegalese population may be in the farming industry because of their lack of education and skills that are needed for other professions. In fact, 10% of the country's GDP comes from migrants who have sent money back home - \$1.1 billion dollars per year to be exact. Following these trends, skilled workers may move out of the country to seek other job opportunities, while the people of Senegal continue in their cycle of unskilled labor (The World Bank Group). Those in the agricultural industry have found their strong dependence on "climate-sensitive activities such as subsistence agriculture, cash crops, livestock rearing, maraîchage (vegetable growing), and daily agricultural labour" may become ill-fated as climate change becomes more and more of a problem (*Climate Risk and Food Security*). In order to raise the standard of living and bring workers back home, special attention must be paid to educating the younger generation so that the workforce may be more evenly distributed across various fields of productivity.

On the Global Hunger Index, Senegal is 37th out of the total 76 countries. Many different factors, including high food prices, local market dependency, desertification and salinization, droughts, and floods, have played a role in the country's food insecurity (*WFP Senegal Country Brief*). Though Senegal's Sahel region is already vulnerable to drought, the last decade has shown even more signs of climate fluctuations to the extremes. The State of the Environment by the Ecological Monitoring Centre's (CSE) report showed that in addition to the 30 percent reduction in rainfall over the last 50 years, a higher frequency of floods have been observed (Sabelli). In comparison, only one flood was reported between 1990 and 2000 while six were recorded during the next decade (*Climate Risk and Food Security*). In 2002 and 2011, there were droughts which affected 200,000 and 800,000 people respectively (Sabelli). Over the last 40 years, floods have affected about 500,000 people every year and caused damage totaling up to 42 million US dollars. Flooding not only causes physical injuries but facilitates the spread of waterborne pathogens (*Climate Risk and Food Security*). During the wet months of July through September, flooding occurs, bringing everything from human waste to random objects. This becomes an opportunity for mosquitoes to lay eggs in containers, and the number of malaria cases goes up. If these occurrences increase, more mosquitoes will be given the opportunity to breed and infect the human population (Yeh). Projections made by the same report show that by 2035, temperatures will increase by 1.1 to 1.8 °C and up to almost 3°C by 2060. This dramatic change in temperature will affect the driest regions most, and there will be an increase in dry spells. Salt will begin to affect the production of rice and vegetables as the water irrigating the fields becomes concentrated. The sea level is predicted to rise by 2100 to cover 8% of the landmass which can cause degradation through erosion. Certain crops that are more resistant to these conditions could prove to be better options for farmers attempting to adapt to the changing conditions (Sabelli).

In addition, climate volatility affects various other sectors. There are various other sectors that are affected by climate volatility. Humans are the main cause of environmental degradation on the African continent, and the population increase and climate change have further exacerbated the problem. It results from poor water management, excessive deforestation, overgrazing, and misuse of herbicides and fertilizers. Degradation currently affects 34% of the territory (Sabelli). Senegal is one of the many African countries where erosion has become increasingly worrying; some areas on the continent are "losing over

50 tons of soil per hectare per year” due to the degradation (Nana-Sinkam). In 2014, Margareta Wahlstrom, the UN Special Representative of the Secretary-General for Disaster Risk Reduction, warned that the flooding in Senegal, which takes place more than 83% of the year in some towns, is so severe that it has been labeled as an emergency situation (“UN Warns Climate Change”). Women are also affected by changes in the agricultural productivity. Their status in Senegalese culture places them at a disadvantage in areas such as education, especially in rural areas where tradition and cultural norms are more often obeyed (*Social Institutions and Gender Index*). One good piece of news is that more and more programs working to benefit the agricultural, educational, and nutritional sectors have included women (*WFP Senegal Country Brief*). Feed the Future is one such organization who focuses on helping farmers by introducing them to new varieties of sustainable seed and teaching them to protect their natural resources and access more markets. The organization also emphasizes that it will “help ensure that women farmers have equal opportunities to access credit, receive training, and own property.” It has been shown that women tend to care more about the health of their children and will typically plant fewer non-staple crops if given access to land (“Dakar, Senegal”, Sabelli). These will be produced for the purpose of feeding families rather than profit, and by varying the types of crops grown, the soil will be able to recover from the drain of nutrients needed by the staple crops. Improving its people’s lifestyles and opening up opportunities for them will allow Senegal to ameliorate its standard of living as a whole for future generations.

Climate volatility appears different in the perspective of a typical farmer from the informed global community. Surveys done by the BBC World Service Trust’s Research and Learning Group showed that while natives have noticed the change in environment around them, they do not associate it with the vast idea of global warming. They hold themselves responsible for the problem rather than the world as a whole and its more industrial countries. The weak understanding of the public and the “opinion leaders” stem from not only their lack of exposure to the information but also their inability to express it. Wolof and Jola, two of the languages of Senegal, do not have “standard translations” for climate change terminology. They have previously established beliefs and explanations such as deforestation causing decrease in rainfall or theological determination for climate related events. The idea of education can be easily oversimplified; a misconception exists that teaching an individual facts and concepts solves all the issues. But changing an individual’s world view, let alone that of a population, is more difficult. It will take time, possibly generations.

On a global scale, Senegal has played active roles in discussions concerning climate change. In the 2015 United Nations Climate Change Conference (COP21) negotiations, Macky Sall, the current President of Senegal, emphasized the importance of emission reductions and having developed countries aid those still developing. He mentioned that the developing countries were also insistent upon not taking the financial help offered. Aid should be accepted so necessary changes and improvement can be made. Senegal participated in the 2015 Economy Community of West African States (ECOWAS), and presented a climate resolution for Western Africa to bring the Earth’s temperature down two degrees celsius. Through its continued interaction with the global community, Senegal can become more informed of the issue they are dealing with and work against this problem with other countries (Fall).

Mitigating and coping with the agricultural effects produced by climate change in Senegal can be carried out through three major steps. The first deals with large scale reforms through political and legal action. There exist many different political instruments which use an economic boost to increase agricultural production and economic prosperity. These programs include the Agro-Sylvo-Pastoral Orientation Law (2004), the National Strategy for Economic and Social Development (2013-2017), the Senegal Emerging Plan (2013), and the Accelerated Program for Agriculture in Senegal (2014-2020). They are a critical part

of “achieving food security, poverty reduction, and wealth creation for the country” (Sabelli). Yet, these programs are focused almost solely on boosting agricultural production as quickly as possible without planning to implement long-term climate adaptation strategies. More appropriate practices for the long term, called Climate-Smart Agriculture (CSA), are promoted by the government and some nongovernmental organizations (NGO). These consist of using better quality varieties of seeds, diversifying crops, intercropping, using natural fertilizer, composting, and natural methods of water management. There needs to be greater governmental encouragement through financial resources and action to implement such practices (Sabelli). In addition, the government should be in charge of financing the construction of infrastructure in order for farmers to access markets more easily. This is perhaps the first step that should be taken, because without the means to communicate or travel, not every farmer will be able to access any aid or information provided. Since currently farmers struggle with getting their products to market or bringing equipment back, the government could build more rendezvous points or markets so that each region of farms could more easily reach them. By bringing all the isolated farms together, networks and communication can be built. Overall, the goal should be to find a long-term, large scale multi-faceted plan that puts climate change as top priority and encompasses smaller related programs. There has already been one strategy, the National Adaptation Plan, put into progress. The concept was approved in 2016 and has yet to be approved for implementation, as according to the website of the Global Environment Facility (“Senegal National Adaptation Plan”).

In addition, funding for action on the federal, regional, and local levels can come from several different sources. The World Bank has funded programs such as the Senegal Sustainable and Inclusive Agribusiness Project, which includes both improving public irrigation works and implementing sustainable practices and costs \$80 million USD (“Projects & Operations”). Other organizations who are willing to aid developing countries such as Senegal through funding should be investigated and utilized by the Senegalese government. The Global Environment Facility is one such group whose only terms are that the country “meet the objectives of the international environmental conventions and agreements” (“Funding”). Funding should also be allocated from different sectors of the economy by the government to support national projects and local education in agricultural sustainability. As of 2013, the poorer half of the country provided for far more than 50% of Senegal’s agricultural GDP, but received less than half of its agricultural expenditures (Republic). The distribution of funding should be revised and benefit those in need more so that the country as a whole may improve. By investing more in the agricultural sector and the chief suppliers of food for the country, Senegal could insure its own food security and the use of sustainable practices in its fields. To receive their share of the capital, farms could be required to abide by certain guidelines when producing their crops and livestock. Although it would be an enforced implementation of the practices, this requirement would insure that the task is fully carried out.

Secondly, to promote food security and create a CSA educated community, programs to provide farmers with insurance should become more available. The National Agricultural Insurance Company of Senegal and the Senegalese government are working on providing subsidies on agriculture insurance so that in spite of bad harvests, smallholder farmers and their families will be able to receive the nutrition they need (Sabelli). The R4 Rural Resilience Initiative project by the World Food Programme (WFP) and Oxfam America has a similar purpose, providing farmers with proper knowledge on how to manage their natural resources, save money, obtain insurance, and use microfinances to support themselves so that during the lean season, they may be able to cope nutritionally and financially (*Climate Risk and Food Security*). During weather-related incidents, farmers may be eligible for compensation for a quicker recovery, decreasing their vulnerability to risks of disasters. Microcredits may also be established for small communities of landholders so that they may join more self-sustaining communities to create an interdependence. Through this, growth can be achieved on a large scale and farmers will be more willing

to spare expenses for sustainable practices. By focusing on financial resilience, households are allowed to invest in otherwise unobtainable equipment and technologies that may promote further resilience for climate change.

Thirdly, and most importantly, there must be programs to educate the farmers themselves about climate-smart planting practices for better agricultural productivity. The government and NGO organizations need to collaborate in order to achieve this goal. The World Bank-Funded West Africa Agricultural Productivity Program (WAAPP) has helped 5.7 million West African farmers and distributed 160 climate-adapted crop varieties. Solutions such as these could not only incorporate volunteers from outside the farming community and country but also provide work for those within it. The incorporation of natives into disaster risk management activities such as the building of dikes or other infrastructure is only fitting; it is they who have to continue with the sustainable practices. Farmers should also be educated on more natural and efficient methods such as using stone bunds to manage water storage ("Times Are Hard and Uncertain"). They should refrain from growing too many groundnuts which tend to be sensitive to climate volatility. Mono-cropping and chemicals result in poor soil, which diminishes crop yield. Cultivated land should be expanded to the maximum (240,000 hectares compared to the 100,000 hectares currently being used) to ensure higher rates of production. Following this, it will be possible to reduce imports of crops that are already produced in the country, improving the country's food security (Rodale). It is essential that climate-smart techniques are included because agriculture's emissions consist of 20 to 30% of all greenhouse gas emissions ("Times Are Hard and Uncertain"). By educating farmers on anticipating climate volatility through practices such as water storage and keeping farm land replenished, agricultural productivity will not only increase but farming as a whole will have gone to a whole new level.

Communication must also be established between the people and the government in order for both parties to be able to function most efficiently. The former should be comfortable interacting with the latter so that requests and/or updates may be exchanged easily to increase the efficiency and effectiveness of the process. A more facilitated procedure for contacting the government through local agencies should be set in place and maintained. It is essential that the people are willing and able to play an active role to make the country better as a whole. They, in turn, need to be comprehensively informed of what climate change is, what the effects of it will be, how it will affect the country's economy, and how it will affect their own families. It is necessary that they are given the facts and the explanations of Senegal's current environmental situation, but there should be an emphasis on the effects of continuing unsustainable farming practices. Tradition and existing beliefs are major barriers to acceptance of climate change, but the discussion of possible consequences would be more impactful. The concept of climate change should be taught to children in school in hopes of creating a more informed generation. Passing out informational flyers may benefit some, but as a large number of individuals are illiterate, setting up radio programs may accommodate larger portions of the population. Radios can reach everywhere, even if electricity and phone service have not been established. It is an important method of passing and receiving information in third world countries. Compared to the 2% with landlines, 76% of African farmers have access to a radio ("Why Radio?"). Both long and short term strategies for establishing a continuous dialogue must be implemented; only one of the solutions mentioned previously will not be able to benefit the country as a whole. The hunger and poverty existing in a country has no one best solution and instead must be tackled from multiple angles.

Without concerted efforts to manage and combat it, Senegal's climate volatility issue will only continue in severity. This must be recognized, and effective actions should be taken as soon as possible to prevent it from affecting people's lives and their future. The key is to utilize adaptive, climate resilient strategies

to improve agricultural productivity and prevent any further damage to the environment. Simultaneously, the standard of living in Senegal will increase as farmers become more connected and able to access markets more easily. While the problem of climate volatility and its effects on hunger may seem simple to solve in theory, actual transformation of practices in the country will need time. Both the Senegalese government and the global community have a responsibility toward this effort. Through a collaboration between the government, NGOs, insurance programs, and the people themselves, Senegal can overcome its food insecurity and slowly create a more sustainable and resilient future.

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