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World Food Prize
East Hampton High School
Country Of Choice: Mali
Topic: Sustainable Agriculture
Focus Of Topic: Drought

Fighting Famine: The Role of Sustainable Agriculture in Overcoming Drought-Induced Food Shortages

Introduction

Food insecurity is a significant issue that impacts populations worldwide. It is estimated that nearly three billion people on the planet do not have the resources to maintain a consistently healthy diet, representing 35% of the world's population [1]. Despite the many efforts in place to resolve this pressing issue, exemplified through subjects like advancements in agriculture and technology, many regions and billions of people still struggle to meet the basic requirements for life. In this essay, I will be specifically focusing on Mali, addressing the food insecurities it faces while proposing one major solution to combat these issues.

Background

Mali is a landlocked country located in West Africa, along the Niger River, and southwest of the Sahara Desert. It has a relatively small population considering its size as the eighth largest country in Africa with a population of 23.3 million people living in an area twice the size of Texas [2]. According to UNICEF, almost a quarter of the population struggles with food insecurity [3].

Mali's northeastern area is mainly covered by the Sahara desert, resulting in it being overwhelmingly rural. While it takes up approximately 65% of the land, the northeast only contains 10% of the country's population. However, the portion of southern Mali, particularly around the Niger River, is an area that is incredibly more populated and economically advanced in comparison to the southern regions [4]. Mali's climate is naturally arid with frequent droughts and has some of the hottest temperatures on the globe [5]. These temperatures can exceed 113°F [6]. The family unit is paramount in Mali, and societal norms expect immediate family members to be of as much assistance to each other as possible. The average family usually consists of five members, two of which are the mother and father, and then the children [7]. They have in the past and still currently face the issue of gender inequality and the oppression of women. The men are often tasked with decision-making of factors that affect the family unit, while oftentimes, women don't have a say in matters, which allows them to take charge at home with day-to-day tasks and responsibilities. Though laws have been put into place to liberate women from these struggles and grant newly defined rights, the Malian government often fails to enforce them [8]. Children bear significant responsibilities, providing for tight-knit families, often foregoing educational opportunities. In Mali, around 73% of children receive a primary education, but as they age, only 15% continue onto secondary education, making the average youth education level a primary grade education [9]. They are expected to give respect to their parents,

community, and elders, and in exchange, these people of authority will protect, advise, and instruct them.

Internet access and cellular technology are not commonplace in Malian life due to the well-entrenched poverty. Connectivity is available to around 7.8 million, or roughly 33% of Mali's population, leaving 15 million without internet [10]. To put this into perspective, by comparison, the United States enjoys over 97% access [11].

The Malian diet is heavily affected by its dry and drought-prone climate, and the principal crops are millet, rice, and corn. Mali's main source of protein is livestock-derived as well as dairy products from the same cattle [8]. For example, if during a drought, Malian cattle or other types of herders suffer livestock loss, they would not only have a core part of their daily diet removed, but also a valuable source of income. When this happens to many herders at once, this double impact would not only affect the individual family but also the community as a whole. This could lead to skyrocketing food prices, markets collapsing, and greater food insecurity, driving people to migrate to other areas where this isn't such an issue. The combination of drought conditions and the absence of animals can directly threaten the survival of many citizens. As an analogy from my own experience, East Hampton, New York, which is my home, is quite dependent on agriculture. This is a strong part of Long Island's history, especially the eastern end of the island. The debate over composting regulations on Long Island, especially in a small hamlet near East Hampton- Sagaponack, can be compared to Mali's struggle with drought and livestock loss. Just as restricting farmers in East Hampton from importing compost would strip them of a key tool for keeping their soil productive, Malian herders losing cattle to drought are deprived of both daily nourishment and economic stability. In both cases, when essential resources are taken away, whether soil nutrients in East Hampton or livestock in Mali [12]. The effects ripple outward, harming not only individual farmers but also entire communities through reduced productivity, rising costs, and deepening insecurity. Mali's grocery stores are often empty at drought season due to crop failure. In this case, the people would have to hope to find various types of fruit, such as mangoes, bananas, pineapples, watermelons, and oranges, to obtain the required nutrients.

Challenge

As mentioned previously, drought throughout Mali is a significant problem that leads to considerable food insecurity. Considering Mali is a country that heavily relies on agriculture for its economy, wealth, and livelihood despite unfavorable conditions, it faces serious issues. Water availability plummets when there is a drought, which directly and negatively affects crops and their yield. However, droughts affect not only crops but also livestock health by reducing water availability and the grazing fields that support them. Demand outpacing supply inevitably leads to a price bump which compounds the problem for the impoverished population making the situation even more dire. Over 43% of Mali's population is faced with poverty, which means that these people are most likely to struggle to afford necessities and food at regular prices but when due to a decrease in agricultural productivity, the scarcity drives up food prices, this part of the population is being hurt the most [13].

Another factor that is affected by the droughts is livestock; many families depend on livestock for not only food but also as a source of income. When a drought occurs, owners are often forced to slaughter or sell at a deep discount to prevent total loss [14]. This can reduce a way of future or current income for many families in Mali, which can also affect them and their financial position to purchase food when it is faced with scarcity. When Mali experiences prolonged droughts and a limited variety of crops and livestock, malnutrition becomes a widespread issue, particularly among children, as ensuring access to a well-balanced diet becomes increasingly challenging [15].

When researching this issue, I researched past methods that have been attempted in fixing this problem that have failed. Emergency food aid provides immediate short-term relief and is life-saving in dire circumstances, but overreliance on it does not aid the country in solving root issues. Emergency food aid is unable to provide long-term solutions to a very pressing problem such as the droughts in Mali. There have also been attempts at creating sorts of large-scale irrigation projects [16]. Though these projects would have certainly helped during times of droughts, their high cost made them unrealistic to be completed. The Malian government is also a key factor in why these irrigation projects have failed, as it is riddled with corruption and lacks the proper management required for large-scale projects to succeed. Barriers such as lack of infrastructure, limited funding, and corruption make it difficult for the government to take on sustainable solutions, but these challenges can be addressed by incorporating international partnerships, and direct input from local farmers. Ordinary citizens also have a role to play by organizing cooperatives, advocating for their needs, and putting pressure on leaders to prioritize long-term food security policies. Inclusion of the needs of farmers and other crucial stakeholders in Mali is something that is required when discussing these projects' failure to do so in the past has added to the failure of these plans.

Exploring a solution

After considering these previously attempted solutions that were not fit for Mali's given situation, there have been other ideas researched and explored, including sustainable agriculture. Implementing sustainable agriculture techniques into Mali's practices can potentially help to combat the pressing problems facing the nation. Varied techniques of sustainable agriculture can aid in Mali's journey to a secure food supply. The most popular form of sustainable agriculture that will be effective for Mali in its struggles, as well as in similar situations, is water management [17].

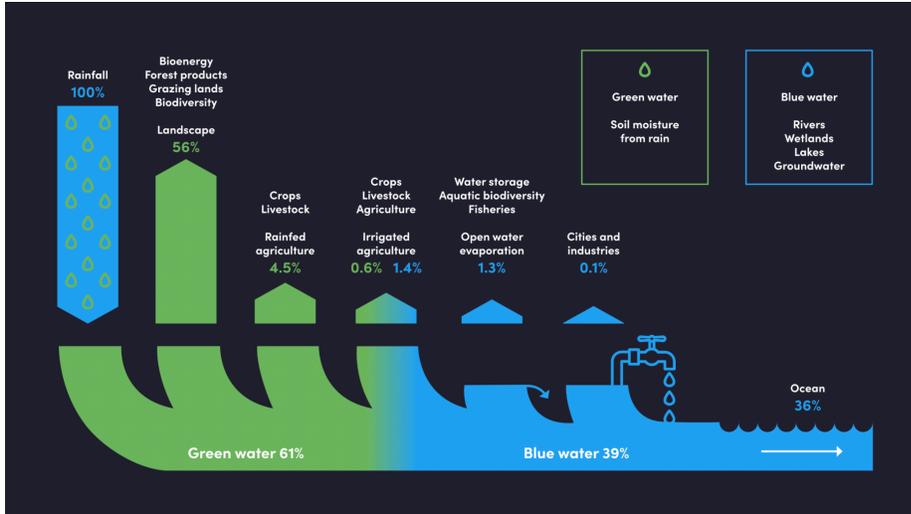


Figure 1: This image illustrates the global challenge of agricultural water scarcity and highlights sustainable water management techniques such as precision irrigation and water harvesting. It is relevant to Mali’s situation because drought and limited water access are primary drivers of food insecurity, making these strategies crucial for improving agricultural resilience (“Sustainable Water Use in Agriculture,” SustainabilityUnlocked).

Recommendation

The solution that I recommend for Malians to continue to battle their food insecurity is effective water management. Organizations such as the International Crops Research Institute for the Semi Tropics have implemented such tactics in Mali in the past and have seen positive outcomes. Proper management strives to ensure the optimization of water usage, specifically tailored to ensure the greatest crop survival and yield [8]. Tactics that Mali could to implement water management could include collecting rainwater and storing it for future use. This would involve some sort of rainwater collecting system. Studies show that the two most accessible systems for this type of project are a daily model, which uses daily time intervals, and a monthly model, which uses monthly intervals. The results of the daily versus the monthly model correlate well with each other through the monthly model, allowing for not only a simpler but also a more versatile approach in rainwater collection [18].

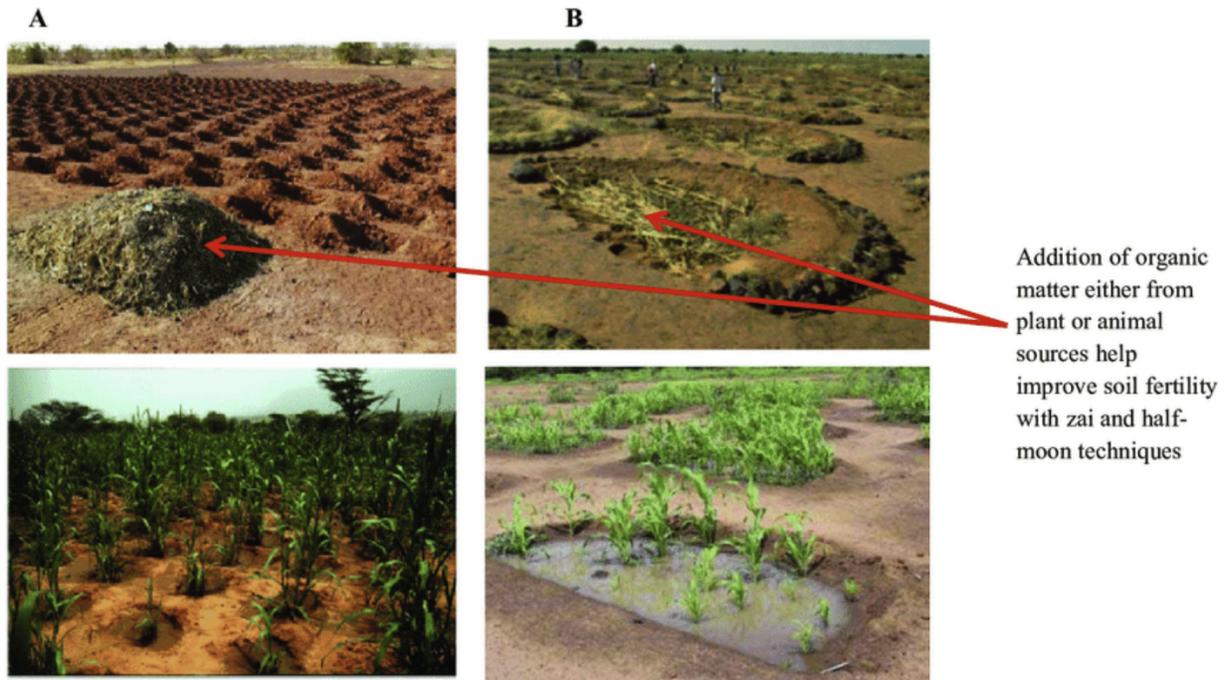


Figure 2: This image shows traditional rainwater harvesting techniques that pertain to a similar concept described in the paragraph above. These techniques are widely used in the Sahel region and involve creating small, semi-circular pits to capture and retain rainwater, enhancing soil moisture and fertility. Incorporating such practices can significantly improve crop yields and resilience against droughts, aligning with your recommendation for effective water management in Mali (Tetteh Partey et al.).

Mali has a considerable amount of international support, and with the help of international development organizations, such as the United Nations International Children's Emergency Fund (UNICEF), the organization focuses on improving water and sanitation [18]. The organization UNICEF is incredibly successful historically; it operates in nearly every country, has evidence-based programs that ensure the programs are tailored to actual needs, collaborates with governments, is highly adaptable, responds quickly to emergencies, and is well funded [20]. Mali has a local organization with similar goals to UNICEF called Plan International Mali, which focuses on children's rights, education, and gender equality [21]. In Mali, organizations such as Plan International Mali work alongside UNICEF to support factors such as children and overall citizen health. These organizations can be supported in their work through consistent funding, stronger partnerships with local communities, and greater coordination with the Malian government to ensure resources are used effectively. International donors can provide financial and technical support, while citizens can help by participating in community programs and advocating for transparency so that aid reaches those who need it most. UNICEF's funding is voluntary and raised annually through a combination of government contributions, donations from individuals and corporations, and fundraising by National Committees in high-income countries [22].

UNICEF, which typically provides financial support for rainwater harvesting systems, could provide Mali with funds for this project by working alongside the Malian government to install the storage systems [24]. However, the tanks would need to be regulated closely, with cleanings at least once a year and every few months, disinfecting of the pumps and pipes [29]. This would entail collecting rainwater from surfaces such as rooftops through gutters, pipes, etc. The water would then be filtered to remove any impurities that could cause harm to health. The water could then be stored in these tanks before being distributed for uses such as irrigation, drinking water, or household needs.

Soil moisture management is another way to ensure that the nutrient levels in crops are high enough to support the health of the people of Mali. This method is similar to crop covering, as it involves applying a layer of organic or inorganic materials to the soil to minimize water evaporation and retain moisture for the crops.

This would require the regular testing of soil to see how much moisture is retained and what could be done to regulate and ensure that enough is present. A specific tool, the tensiometer, is a device used in agriculture to measure the water tension in soil, indicating how much water is available for plant roots [25]. It is most likely the best fit for Mali to use when testing the soil. The tool has a relatively low cost, is portable, and easily usable for farmers. The tensiometers' simple instructions will benefit the farmers because they will not have to receive extensive training or additional education that could take away time from their crops. The information that the tensiometer gives when used is direct and important, without additional work needed to be done in order to understand the condition of the soil. The convenience of this tool allows virtually anybody to use it and makes the lives of everyday farmers easier. While tools such as Neutron Probes are very useful in some situations, this tool is not a good fit for Mali. The neutron probe is a very expensive tool that requires trained technicians and strict protocols due to the radiation that it produces. They are also not portable and highly inconvenient for everyday farmers [26]. The solution would prevent evaporation in the crop's soil, which would improve water retention and enhance the crop's resilience [27]. This solution could be executed by Mali's Ministry of Agriculture, which oversees and manages the food security of Mali [28]. The organization has a large control over how the country implements projects. This project does align with the government's goal of helping to conserve water, so this could potentially be funded by Mali's Ministry of Agriculture. This solution would ensure that the soil retains enough moisture to support healthy plant growth in dry conditions.

Water recycling is another form of water management that could work for the problem of food insecurity in Mali. Water recycling could work by collecting wastewater from the homes of families in Mali and treating it with chemical treatments. Organizations such as Univar Solutions, which is a leading distributor of water chemical treatments, could help to get these treatments to Mali [18]. The recycled water is then stored in water tanks and reserved for when it's needed [31].

While this solution could be great for Mali, it does come with its drawbacks. It will require funding, though it will not be merely as much as previously attempted solutions and will probably require the support of international allies to get the proper needed resources. The good news is that Mali does have a substantial amount of international support that could help the

country out [31]. Overall, water management is the most realistic and attainable solution. It would provide the country with quick relief and also long-term due to some of the main goals of improving the quality of crops.

Conclusion

Implementing water management would help farmers maintain crops and livestock during droughts, stabilizing food supply and prices while improving nutrition and income for families. These systems would build resilient communities, enhance soil health, and reduce Mali's reliance on emergency food aid. They would also create new opportunities for local employment, improve access to clean water for both agricultural and household use, and reduce conflicts over scarce resources. Better water management could strengthen local markets, support children's education by reducing the need for families to migrate in search of food, and improve public health through more reliable sanitation. Partnering with organizations like UNICEF and Plan International Mali would provide funding and expertise, creating a long-term, self-sustaining solution that strengthens food security, economic stability, and overall national resilience.

The issues that Mali is faced with call for solutions that can provide not only quick immediate relief but also address and conquer the underlying problems. By facing the issue of drought and tackling it to permanently put it at rest, a strong solution is needed. Implementing sustainable agriculture water management tactics can be incredibly beneficial to Mali in dealing with droughts. Mali will need to collaborate with international forces as well as organize its government to be able to establish a secure food system with these solutions in place. An increase in agricultural productivity, enhancing soil's short and long-term health, creating a wider range of accessible water, and a strengthening of food systems, as well as many more positive effects, can all occur if Mali is able to construct these solutions.

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