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Mozambique: Responding to Climate Change and Adapting Agricultural Practices

Mozambique is an agricultural country located in Eastern Africa. The people who dwell in this country are either poor and don't have a job, or they work on a farm. Without farming, their entire livelihood would vanish. Every community in Mozambique depends on their agricultural production in order to survive, but there is no guarantee that their crops will turn out successful every time harvest season comes around. Mozambique is a country that is under the care of the United Nations and their eight Millennium Development Goals. These goals were created to help improve the lives of over one billion poor people in the world. Mozambique is expected to meet all eight of the Millennium Development Goals by the year 2015, but they should mainly be focusing on their environmental sustainability goal. The agricultural aspect of Mozambique is the most important part of their society, so they must focus all of their energy towards that before they begin any other projects. Without the agriculture, the environment that the people of Mozambique live in would no longer exist. The main concern for Mozambique is the constant climate changes that they experience. The amount of natural disasters and temperature changes that occur in Mozambique are very intense. Mozambique is more prone to all of these disasters because of its location on one of the most fragile continents on the planet. Mozambique is also surrounded by many rivers that can cause flooding on their farms. The farmers of Mozambique need to be able to protect their crops because almost all of them use their fields to feed their families. Not very many farmers can produce enough food to sell at the market, but if the United Nations start to aid them, there is a possibility that Mozambique will be able to export more goods than they have to import. To help aid the agriculture process, the United Nations will need to supply support for the people of Mozambique. By supporting the farmers, the United Nations will come closer and closer to meeting one of their eight Millennium Development Goals. The environmental sustainability goal will be accomplished through a series of programs that focus on many different factors including ones that involve climate change and plant alterations.

The "typical" subsistence farm family in Mozambique is generally composed of five members ("Mozambique"). Many times, the house contains three generations, from grandparent to grandchild (Taylor, "School is in Session."). The family kitchen is located outside and consists of iron pots on hot rocks all year long. Some people who have visited Mozambique have been pleasantly surprised by the great food and cooking methods used by the women there (Taylor, "Life in the Kitchen."). The family food is usually hard to come by. One farmer said, "If I had a goat, I would sell it for \$20 to buy a bushel or two of corn to sustain my family when it floods" ("Mozambican Farmers"). The main diet of a typical subsistence farm family in Mozambique is cassava and green, leafy vegetables. The cassava diet is a common diet for families located in the northern part of the country. The cassava they eat is a staple crop with a low amount of protein content. The diet of the southern and central families includes maize, imported wheat, and more green, leafy vegetables. All of the diets in Mozambique include green, leafy vegetables, but aside from that, their diets don't include food found in the micronutrient-rich category. Micronutrient-rich food would include other vegetables, fruits, and food of animal origin. The problem with this type of diet is the fact that, from day to day, there is hardly any diversification. Since the foods found in the diets of the people of Mozambique are poor in micronutrients, it doesn't help fuel the population or give them the energy they require. Their diets then lead to chronic malnutrition and deficiencies including iodine and vitamin A deficiencies ("Mozambique: Summary").

The schools in Mozambique look different on the outside, but the inside are very similar to the schools in America. They have black boards with a section dedicated to homework assignments, a section for

spelling, and a section of math problems. The children at the school, however, are very different from the children at the schools in America. The children of Mozambique are excited and optimistic towards their schooling. They know the education they receive is important and they look forward to the day they'll be able to show what they've learned (Taylor, "School is in Session"). Education is not only appreciated by the children, though. The parents also encourage their children to attend the schools. One man said, "When I get thirteen or fourteen goats, I will sell them to buy my children school supplies and clothes. Children are our wealth. They'll bring a better future for us" (Gellerman). The adults of Mozambique are very aware that their children's education is a key factor for not only their children's future, but the future of their country. Along with paying for an education, the adults must consider paying for health care. The access to health care in Mozambique isn't always simple, though. Less than 40% of the entire population of Mozambique has access to health care. (Taylor, "Life in the Kitchen"). Sadly, northern health care is harder to access than southern health care ("Mozambique: Summary"). The fact that a person's location will determine if they'll have access to health care is absolutely terrible, but some companies have tried to do something about it. Integrated Network, for example, has set up 20four day clinics and they're estimated to receive 100,000 new AIDS patients annually ("Mozambique: The Challenge of HIV/AIDS Treatment and Care."). Access to health care in Mozambique is very important because over 16% of the adult population becomes infected with HIV/AIDS each year. There are also approximately 600,000 orphaned children between the ages of zero and seventeen. These children have become orphans because HIV and AIDS have taken the lives of their parents ("Mozambique").

The average amount of land area per family in Mozambique is about 1.4 hectares ("Mozambique"). With this, the family can generally make it through anything. Almost all farmers in Mozambique are subsistence farmers. This means the farmers can only produce enough crops for survival purposes. There are, however, and handful of farmers who are able to grow a small surplus of crops and they sell their extra cash crops on the market. One organization, Save the Children, gave twelve farm families in Mozambique five acres to grow cash crops. These families used some of the field to grow their own dinner, but they all were able to grow surplus crops and sell them at the market. This has helped them greatly since their previous farms had been destroyed by natural disasters ("Mozambique- Agriculture"). The most common food to be grown by farmers includes maize, cassava, and cowpeas ("Mozambique"). A lot of the time the farmers grow tomatoes, onions, cabbage, and collard greens on higher ground and on lower ground they grow maize and sweet potato (Gellerman). Each farm is tended to by every member of the family. Everyone must help in order to produce enough food to get by. Modern agricultural practice and tools, such as tractors, electrical plows, good quality fertilizers, and pesticides, are hardly, if ever, used by the people of Mozambique. The farmers don't even have the luxury of artificial irrigation channels and networks. They must rely entirely on the rainfall to obtain their water for irrigation ("Mozambique Agriculture"). Poor agricultural practices aren't the only obstacle the farmers of Mozambique must face. There are several major barriers to improving their agricultural productivity and many of them are out of their hands. Natural disasters, including floods from January to March, two droughts in their postwar period and cyclones greatly cripple their agricultural productivity ("Mozambique- Agriculture"). Land availability, surprisingly, isn't a problem. The land is abundant, but the expansion is greatly limited because of the lack of labor, a suitable farming system, and access to water ("Mozambique"). The fluctuations of international prices also have an effect on the amount of production done by the farmers. If prices decline drastically, the farmer will not be able to make enough money with the crops ("Mozambique- Agriculture"). Not making enough money is a huge problem because over 80% of all Mozambique families are farmers. If they can't make money from agriculture, their lives and their children will suffer greatly (Gellerman). The agriculture minimum wage in Mozambique is 2,005 meticaís which is about seventy three dollars in the United States. ("Mozambique: New Minimum Wages Announced"). Without this money or their farms, many families would starve. In order to get the money from their crops to keep their family alive, the farmers must have access to food markets and adequate nutrition. This is a problem for most farmers because around one third of the supply of food in Mozambique still depends on imports. When food aid shipments are down, everyone's plate

becomes emptier. In the rural parts of Mozambique, the physical access to food is what prevents their stomachs from being full. During the civil war, the country's infrastructure, including markets and roads, was destroyed. Now, the people in rural Mozambique have no way of accessing the food markets or adequate nutrition. In the urban areas of Mozambique, it is more of an economical constraint that prevents them from accessing food. As prices of food rises, the amount one family can purchase becomes less. This can lead to a poor diet and malnutrition ("Mozambique: Summary").

One factor that affects agricultural productivity, household income, and the availability and quality of food is the climate changes of Mozambique. Studies predict that, by 2020, the crop yields in Africa will decrease by 50%. This is not only a threat to the farmers' income but a threat to their diets as well. The worldwide temperature is predicted to rise by four degrees Celsius and the sea level is even expected to rise at least thirty centimeters. These changes will result in less rainfall for subtropical regions, create more frequent droughts and dry spells, and an increase in soil erosion. These climate changes will make it very difficult for any farmer to make a living. This poses a huge problem for the people of Mozambique because they rely so heavily on agriculture to make a living. A decline in crop yield will not allow farmers to produce enough food for their income or for their families. The less food there is for the population, the less food everyone's diet will contain (Till, Artner, Siebert, and Sieber).

In present day Mozambique, the climate still plays a huge role. Mozambique is located in one of the most vulnerable continents and could very well be one of the most vulnerable countries in Eastern Africa. In 2000, for example, a devastating flood caused by hard rains and back to back cyclones killed over 600 people and affected millions of others. The climate of Mozambique directly affects the community and the environment. Today, Mozambique's climate is still changing because of the location of the country. Mozambique is surrounded by nine major rivers. These rivers are located in other countries, so the rainfall in those countries contributes to the levels of the rivers in Mozambique. Although the climate isn't severe right now, it still alters the environment of Mozambique. With each flood, drought, cyclone, and rainfall, the soil of Mozambique is shifted around and loses some of its quality. The floods and the cyclones wash and sweep away the good topsoil that the farmers need to produce a successful crop. With each climate change or alteration, the quality of the soil goes down and so does its ability to yield a crop that will do the farmer and his family good ("Climate Vulnerability in Mozambique"). The fact that farming is a family operation means that women are directly involved in the farming process. This doesn't put them at any more disadvantage than their male counterparts. Sixty percent of those involved in agriculture are women and they would be just as affected by all of these climate changes as a male (Gellerman).

Climate change in Mozambique develops over time. The chances of changes occurring vary from day to day because each day brings new weather conditions. The chance of a natural disaster occurring in Mozambique does increase over time. Each day is another step closer to a drought, flood, or cyclone. To study the different climate changes and measure their status, they perform down-scale scenario work. This down-scale scenario not only looks at the current status of Mozambique's climate, but it also makes projections for the future. The measurements help predict how vulnerable Mozambique will be to future disasters and climate changes. Since determining if the climate will worsen will never have a guaranteed answer, the farm families have to constantly be ready for anything. The situation for them will only worsen if the climate begins to decline. Each day is closer to a natural disaster, so that part of the situation will worsen day by day without falter ("Climate Vulnerability in Mozambique"). Improving the climate changes wouldn't be possible for the people of Mozambique, but they can work on improving the agricultural practices and policies. In order to improve their amount and quality of food and the money available to their family, they must work on increasing the carbon sequestration for their crops. They also have to focus on supporting ecological resilience to erratic weather, rising temperatures, droughts, and shifting plant disease transmission and pest infestation. By increasing the carbon sequestration, the people of Mozambique would be managing the amount of carbon dioxide in the air and the amount that is being stored and used in the carbon cycle. The process of carbon sequestration begins with the capture of carbon

dioxide that was produced by burning fossil fuels. The carbon dioxide will then need to be separated from the other gases and stored in an underground reservoir. Carbon sequestration processes have been and are currently being discussed in Mozambique. This process hasn't been put into full effect yet because there are several unanswered questions about the whole ordeal. The financial aspect is a big question. Separating and storing these chemicals isn't free and finding funding for it isn't exactly easy. The location of the reservoirs is also a huge question because it not only deals with geography, but it also deals with the people living on the land. However, carbon sequestration is a well-known practice used by many countries in an effort to conserve soil. Soil conservation would be useful to the farmers of Mozambique because they would then be able to produce the top level crops they and their communities need in order to survive. It may be difficult to accomplish, but if they were able to increase carbon sequestration it would not only better the environment, but it would also benefit the farmers and, in turn, the impoverished people of Mozambique. Better soil will produce more food and will provide food for the poor. Women, urban dwellers, and farmers would all equally benefit from the management of carbon dioxide ("What is Carbon Sequestration?").

Population growth, water scarcity, urbanization, energy demand are a few factors that don't have huge effects on the climate of Mozambique. The factors, actually, are more likely to be the ones that are affected by the climate changes of Mozambique. A growing population could hinder Mozambique's ability to perform carbon sequestration because more people would mean more carbon in the air. With more carbon in the air, the speed of carbon sequestration would have to be greatly increased in order to keep up with the ratio of carbon being stored and carbon being emitted. An energy demand could be a potential threatening factor for climate change because it could cause more need for factories that would emit harmful chemicals. The possibility of this occurring in Mozambique is very slim, but, as long as there is a chance, no factor should be ruled out. Water scarcity is a major problem in Mozambique at almost all times of the year. Water scarcity is a factor that would affect Mozambique's attempts to support ecological resilience to climate changes and erratic weather. Some ecological resilience programs require a sum of water in order to be successful, and Mozambique would not be able to fulfill this need because of their water scarcity problem. In an attempt to address this problem of climate change and support ecological resilience to erratic weather, the farmers of Mozambique should start varying their crops. Crop variation will not only help replenish the soil in their fields, but it will also give the people of Mozambique some variety in their diets. Along with crop variation, they'll have to adjust their everyday routines to fit the climate. As the climate begins to change, their routines will have to adjust so the timing of processes such as planting, weeding, or harvesting can be coordinated with the climate change. New and adjusted techniques of water conservation and irrigation are two other techniques that would greatly help the production of agricultural products and give farmers a feeling of food security. Some farmers may find that, as the climate changes, they'll have to switch from agriculture to livestock. This isn't always a bad change because livestock can be considered a type of market insurance. The livestock is market insurance because it will produce a much larger profit when the time comes than any crop ever would. Some scientists have looked into the potential of livestock being used in climate varying locations and they've begun to create livestock that are resistant to drought conditions. Advancements in climate adaptation for plants have led to the creation of the New Rice for Africa, also known as NERICA. This rice has combined the useful traits of two different rice species to create a grain that is essentially drought-resistant. (Till, Artner, Siebert, Sieber).

Programs that would be useful to the country of Mozambique include the Global Environment Facility (GEF) and the Small Grants Programme (SGP). These two programs have successfully installed water taps into 75 homes in a small island country. Access to running water would not only help with cooking and everyday tasks, but it would also greatly relieve the stress of having to get water and bring it back home. This tap water could also be used to fill pitchers and water a small garden outside the farmers' homes, allowing their farm to be completely dedicated to cash crops ("Water Project Making Life Easier"). The Africa Adaptation Programme is another hard working group created by the Millennium

Development Goals (MDG). This program is located under the United Nations Development Programme (UNDP) which helps create innovative approaches to climate change adaptation in Africa. This would most definitely benefit the citizens of Mozambique because they would be able to associate themselves with people who focus entirely on their continent. MDG Carbon Facility and UNDP/GEF also help with carbon conservation and the creation of climate resilient plants (“Programmes and Initiatives”). A local project that would be a great focus for the people of Mozambique is to look into the UNDP/GEF programs to help them create plants that will stand up to their harsh climate. The plants grown in Mozambique take a beating with the weather constantly changing. The farmers need to look into securing strong plants that will be able to withstand the droughts and the floods. With the help of UNDP/GEF and the MDG, the farmers will be educated on these varying plant types and begin to look into what plants would do well in Mozambique.

Working together will allow the farmers to learn about the science behind the plant and it will allow the scientists to learn about what’s really happening every day with the Mozambique climate. In order to accomplish this goal of having every farm own a genetically varied plant that will withstand the harsh climate of Mozambique, the community, national government, organizations, and farmers must all play a role. Farmers and scientists must work together in order for this idea to take flight. To begin this process, scientists must either locate or create genetically engineered crops that are able to withstand the climate Mozambique has. Beans and cassava are two crops that would do well in Mozambique during droughts. Beans are able to withstand droughts and cope in dry weather just as cassavas are. The interesting thing about these crops is that the farmers of Mozambique already grow cassava. This is an encouraging realization because it can act as a link between the fields of Mozambique and the labs of the scientists. Aside from crops that can hold up during droughts, the scientists would want to research plants that can survive in floods, monsoons, and cyclones. The flood plants must be able to take on an obscene amount of water while the monsoon and cyclone plants must have deep, strong roots. Along with researching, the education of the people of Mozambique must be at the top of the list of priorities. The community must be educated about the benefits and consequences of the different plants the scientists have researched and engineered. Not only will the community have to agree with the information they’re being taught, but the nation government must also agree in order to run a successful operation. Educating the farmers will show them that there is nothing wrong with the new crops and, in fact, using the new crops will help them greatly in the future. Education and research can be organized by the UNDP. The UNDP has focused on creating stable environments for many years now and is known for its success. To create a stable environment in Mozambique, the UNDP would need to work with the GEF to sponsor research, provide supplies for education, and locate personnel to help with the research and education process. The MGD would have to be the overall leader in this process because they will need to be the ones making sure their goals are being taken care of. The rural farmers would be the key players in the entire process because they would be the ones who actually test the new plants in real life. The scientists can perform lab tests as much as they want, but when it comes down to it, it’s what happens out in the real field that matters the most.

Mozambique is a very vulnerable country located in Eastern Africa. With each passing day, the farmers of Mozambique become one step closer to another natural disaster. These farmers need to be prepared for all kinds of weather extremes including droughts, floods, and cyclones. With the help of the United Nations and their eight Millennium Development Goals, the citizens of Mozambique will be able to stand on their own two feet again. The goals developed by the United Nation consist of several different factors including ones involving food security, education, medical care, and developmental assistance. The most important goal, however, deals with environmental sustainability. By making the farmers of Mozambique feel comfortable with the way their crops will turn out, the UN will have accomplished one of their eight Millennium Development Goals. Developing, studying, and improving different crops in Mozambique will allow the farmers to actually produce a surplus that they will be able to take to the market each week. As the farmers begin to take the food to the market, they’ll be able to put more money back into their

farms and possibly invest in some better agricultural practices. Being able to buy new, productive tools and begin new agricultural practices will not only make the farmers of Mozambique feel better about the way their farm lives are going, but it will also produce an even better product in the end. The more scientists focus on improving the first crops for the farmers of Mozambique, the better off the farmers will be in the future. Creating genetically engineered plants that withstand erratic weather is an effective way to begin Mozambique's journey to accomplishing all of the MDGs set by the United Nations. After accomplishing the environmental sustainability goal, the other goals will all fall into place. Having scientists design and create improved crops will result in all of the farms producing a high quality and high quantity of food. Once there is more food and the people of Mozambique have discovered that the new crops are there to stay, their diets will greatly benefit. Each person will be able to be fully fed at every meal and they'll even begin to have leftover earnings from the cash crops they were able to grow in their fields. This extra money will allow the owners of the farms to either reinvest it into their farms or to invest in medical care for HIV/AIDS, malaria, and other diseases. Since so many adults become infected with HIV/AIDS, having medical care is a very important goal for everyone in Mozambique. Conveniently, this is another goal the UN set up under the MDGs. After looking at all of the options, anyone can see that starting with environmental sustainability is the best route for Mozambique. By starting with the factor that the people of Mozambique rely on the most, the UN will be able to successfully accomplish nearly every goal they hope to accomplish by the year 2015.

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