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Mozambique, Plants (as well as Sustainable Agriculture, Climate Change, Malnutrition)

Implementing Enset to Solve the Wheat Crisis in Mozambique

Many have tried, however few have succeeded in finding a suitable wheat replacement that can face the effects of climate change and overcome the many drawbacks of wheat. Mozambique is currently plagued with malnutrition, is inefficient in its agricultural productivity despite its massive potential, is heavily reliant on wheat imports, and is extremely vulnerable to the devastating effects of climate change. Enset, the “false banana”, has the potential of replacing wheat on a large-scale. It is sustainable, high-yielding, and nutritious: all factors that’ll benefit Mozambicans. Its stability and potential can possibly feed millions and employ many vulnerable Mozambican women.

Mozambique, a country in southeastern Africa, is divided by the Zambezi River, forming two separate regions (“Map of Mozambique, Africa”). Due to its location next to the Indian Ocean, it is often affected by natural disasters like droughts.

Mozambique has a tropical to subtropical climate, optimal for farming. It has diverse terrains: Northwestern plateaus, western mountains, and coastal lowlands (“Mozambique” [World Factbook]). In addition, Mozambique has a multitude of arable land available for farming (“Mozambique: Three Billion Metacais for Agricultural Research”). Often in its central and southern provinces, many natural disasters, such as “severe droughts; devastating cyclones and floods” (“Mozambique” [World Factbook]), have been occurring. Due to the Intertropical Convergence Zone (ITCZ) and La Nina, disastrous flooding has been especially common during Mozambique’s rainy season, harming its infrastructure and its “water sanitation and electricity supply systems” (“World Bank Climate Change Knowledge Portal”).

Family and community are deeply embedded in Mozambican culture. The typical family consists of 4.3 people (“Average Household Size in Mozambique”), usually working in the unprofitable and unproductive agriculture, fishing, or forestry industries (“Find a Job in Mozambique and Learn What Working Here Is Like”). In fact, the agricultural industry, Mozambique’s largest, employs 70% of the workforce (Ricardi). Mozambicans earn an average income of \$331 USD annually, extremely low compared to the US’s average income of \$54,132 USD (Russo).

62.37% of Mozambicans live in rural areas (“Rural Population Percent of Total Percent”), high compared to 38.8% who live in urban areas (“Mozambique” [World Factbook]). Most Mozambican farms are 1-2 hectares (“Agriculture Sector in Mozambique”), which are miniscule compared to the average American farm at 178.4 hectares (“Industrial Agriculture and Small-Scale Farming”). Major crops there include rice, maize, sorghum, and cassava (“Climate-Smart Agriculture in Mozambique”), while aluminum and coal briquettes (“Mozambique” [OEC]) are the most common exports. Currently, Mozambique produces only a small amount of wheat, mainly in its western Tete province.

Wheat is the backbone of Mozambican cuisine. *Xima*, a porridge made from sun-dried cereal crops, is Mozambique’s staple food, commonly eaten with meat, vegetable stews, and seafood (Fawzy). Bread is a staple in Mozambique: to this day, there are many small bakeries in each neighborhood offering fresh bread daily, rather than bread sold commercially. Cassava, sweet potato, and other local crops are popular in rural areas where bread is less common (“Wheat Crisis: MIC Suggests Substituting Bread With Local Product - Noticias”).

Education quality in Mozambique is lacking. The Republic of Mozambique ranks as #168/177 for countries in education, one of the worst in the world (“Education”). Its overall literacy rate is 47% (“Education”). There exists a gap in education past primary school, especially for girls. After fifth grade, only 11% of girls continue their education, and even less continue to college (“Education”).

Mozambique’s healthcare remains very limited. There are few doctors (“Global Health”), and health facilities aren’t easily accessible: most Mozambicans live more than an hour away from the closest facility (“Global Health”). In addition, medicine is expensive and often runs out quickly. Therefore, some of the elderly population opt to take traditional medicine instead of modern treatment (“The Food, Fuel, Finance Crisis: Mozambique Under the Spotlight”).

Infrastructure in Mozambique remains underdeveloped. Approximately 21% of roads are paved (“Climate-Smart Agriculture in Mozambique”), 70% of people don’t have access to a sanitation system, and half of people lack access to water (Mwemedi). There are approximately .49 mobile phones per person as compared to 1.1 in the US (“Mozambique” [UNESCO]). Electricity is limited, as only 22% of the rural population have access, and 57% of the urban population (“Mozambique” [World Factbook]).

Mozambique has been suffering from high rates of malnutrition. Currently, 44% of all Mozambican children are malnourished (“Malnutrition in Mozambique”). Widespread malnutrition has contributed to extremely “high levels of childhood mortality” (“Malnutrition in Mozambique”) and higher vulnerability to disease. Malnutrition is caused both by “iron, iodine, and Vitamin A deficiencies” (“Malnutrition in Mozambique”) and by sanitation issues: with worms, malaria, and diarrhea all harming Mozambicans’ nutrient uptake (“Malnutrition in Mozambique”).

Mozambique is considered a multiparty democracy and a republic (“Government”). Mozambique is divided into 11 provinces consisting of multiple districts, each led by a governor appointed by the President (“Government”). Recently, Mozambican President Nyusi declared his plans to invest three billion meticaïs (\$46,989,990 USD) into further agricultural research in order to improve Mozambique’s low agricultural productivity (“Mozambique: Three Billion Meticaïs for Agricultural Research”). Because Mozambique neglects extensive agricultural research, there exists a lack of an independent and profitable agricultural sector, even though it’s responsible for “85 percent of the rural economy” (“Mozambique: Three Billion Meticaïs for Agricultural Research”).

In addition, impacts of the Ukraine-Russia conflict have harmed wheat production and exportation globally, especially in Mozambique. Ukraine and Russia are among the world’s largest producers of wheat: however, due to conflict, their production has dramatically decreased. Due to this, Mozambique’s Minister of Industry and Commerce Silvino Moreno has warned that Mozambique’s wheat stock may not be long-lasting (“Wheat Crisis: MIC Suggests Substituting With Local Products - Noticias”). Moreno has advised research for bread alternatives to combat rising wheat prices likely to negatively affect Mozambicans who rely on staples like bread and *xima* for survival.

Without immediate action, the conflict can adversely affect current progress toward food security in Mozambique. Despite its optimum conditions for cultivating crops, Mozambique relies heavily on imports to support its food deficits (“Malnutrition in Mozambique”). According to the Food and Agriculture Organization (FAO) (“Nutrition Comes From Gardens”), Mozambique imported 747,321.88 tons of wheat in 2021 alone, costing \$252,179,000 USD. In other words, Mozambique depends on imported wheat for “90 percent or more of the wheat consumed in the country” (“Ukraine May Supply Wheat to Mozambique”). However, the Ukraine-Russia conflict has only increased the price of wheat. Though Mozambique has tried to increase its own production and use wheat alternatives like cassava

flour to produce bread (“Ukraine May Supply Wheat to Mozambique”), due to low agricultural productivity, nothing has been successful so far.

According to research, by 2100, wheat could potentially suffer a 22% crop loss (Lakhani, "Our Food System Isn't Ready For the Climate Crisis"), as global heat and natural disasters harm agricultural productivity in crops vital to our food system. For example, “prolonged drought could affect 60% of wheat growing regions by the end of the century” (Lakhani, “The Race Against Time to Breed a Wheat to Survive the Climate Crisis”). These potential huge losses in wheat production would starve millions of Mozambicans relying on wheat for food.

These drawbacks to wheat affect all people: women, men, the elderly, children, rural populations, urban populations, and marginalized people. Wheat production also harms soil health, and often uses non-organic pesticides detrimental to the environment (Marie).

A possible solution to Mozambique’s growing wheat crisis is implementation of the enset plant. Enset is a wild African plant related to the banana, though the fruit of the enset itself isn’t edible (Berhanu). It can grow to 10 meters tall (Borrell and Koch), has banana-like pods filled with seeds, and is harvested similar to a root vegetable - by removing the entire plant (Rummel).

Known also as Ethiopia’s “tree against hunger” (“Ethiopian Crop ‘Enset’ Identified as Climate Coping Strategy in Drought-Prone Regions”), enset is made up of hundreds of different varieties, all with varying qualities. It has been cultivated for “approximately 10,000 years” (Seeley). This mighty wonder crop could potentially lead over 100 million people out of hunger with correct implementation (Rosane).

It can be eaten in multiple ways: to make *kocho* (bread) from its starchy pseudostems, as well as *xima* (“Mozambique Country Profile”), both important staples of Mozambican cuisine. It produces *bullu* as well, a “dehydrated mixture of the juice from the scrapped leaf sheaths, pulverized corm, and grated stalk of the inflorescence” (Berhanu), as well as *amicho*, a “boiled stripped corm” (Berhanu). In addition, the starch collected from enset lasts long, potentially allowing use for multiple years once fermented, which is especially helpful in areas where refrigeration is unavailable (Borrell).

Enset is highly nutritious: enset-based food can provide up to twenty times more calories compared to cereal-based food (Berhanu), providing large amounts of energy to consumers. It also contains high amounts of calcium, iron, and potassium (Berhanu).

Enset brings many benefits to its producers and can potentially be produced globally. It is perennial, can grow under diverse conditions, and can be harvested even when immature and at any time of the year (Borrell). Enset preserves soil health, whilst cereal crop production causes land to become infertile unless sprayed with chemicals harmful to the environment (Seeley). In addition, it doesn’t require high maintenance to grow and manage, allowing farmers to concentrate on other crops as well.

Enset is an Ethiopian staple, though largely unrecognized outside of the Ethiopian Highlands, where it is grown abundantly. Though some of its wild relatives exist in other parts of Africa, including Mozambique, no other country fully takes advantage of the benefits enset has to offer. This demonstrates that enset varieties have potential to be cultivated in multiple, diverse climates. In addition, its native population in Mozambique proves that enset can likely thrive in the Mozambican climate on a large scale without overpowering native plants.

Enset has greatly benefited Ethiopian communities cultivating it. Enset “makes up 17.5 percent of food intake in rural Ethiopia” (Berhanu), feeding around “20 million Ethiopians” (Borrell). In addition, enset

prevented starvation in its communities during the 1980s Ethiopia famine, considered “one of the worst humanitarian events of the 20th century” (Reid). Though the famine caused over a million deaths (Reid), communities producing enset at that time were reported to have “little-to-no food insecurity” (Borrell) due to ensets’ large yield and high nutritional value. In fact, compared to other starch crops, enset produces “the highest yield per hectare in Ethiopia” (Borrell). Each individual mature plant of enset can produce “up to 40 kg of food” (Berhanu).

Its uses extend past consumption: parts of the plant, such as its leaves and stalks, can be used in many different ways. It creates clothing and can be produced for shelter and baskets. In addition, it has many medicinal properties, being used to stimulate “placenta discharge” (Berhanu), as well as to “heal broken bones and reduce swelling of joints in both livestock and humans” (Berhanu). This would be especially helpful in a country with such few doctors.

Mozambique could especially benefit from growing enset. With its growing demand for wheat, it requires immediate implementation of sustainable crops that can withstand environmental challenges while providing food for its large population in need. Its small farms can only access a limited amount of seeds, fertilizer, and tools to cultivate crops, and are “dependent on rainfall for irrigation” (“Ethiopian Crop ‘Enset’ Identified as Climate Coping Strategy in Drought-Prone Regions”).

However, one drawback to producing enset is its complex and varied production by location. It would require deep insight and further agricultural research to determine multiple fit varieties (to preserve genetic diversity) that can be cultivated in multiple climates. Due to its little recognition, little research has been done on its implementation potential. Therefore, producing enset would require in depth research by organizations such as the United States Department of Agriculture (USDA) about the implementation of enset in Mozambique.

In addition, enset has a low protein content. However, *kocho* is often eaten with other nutritious, protein-filled food to offset the lack of protein, such as kale and kitfo - which decreases rates of Vitamin A deficiency in enset-growing communities (Berhanu).

Implementation of enset must be based on local influences rather than national. Because of Mozambican culture revolving around family and community, much of their customs “stem from local influences” (“Malnutrition in Mozambique”). Modern media technology, e.g., radios, TV, computers, and Internet, is limited and inaccessible to many, making social media campaigns impractical.

Therefore, my proposal is to recruit and train dedicated “care mothers” to teach their communities about enset’s potential. These care mothers would each come from different rural communities across Mozambique to represent their villages. Care mothers will be sent to the Ethiopian Highlands to learn about how to maintain, harvest, and process enset from the local enset farmers. Care mothers will mainly learn how to take care of the variety *ensete ventricosum* due to its high productivity and success in Ethiopia. This would also require interpreters to translate for Mozambique’s diverse linguistic population, such as Portuguese, Makhuwa, Tsonga, and Nyanja (“Mozambique” [*World Factbook*]).

As Mozambique consists of 129 districts (“Provinces of Mozambique”), I suggest initially employing 250 care mothers to represent each district, totaling 32,250 women. They’d come to Ethiopia in waves of 500-1000 women. Care mothers would initially stay in Ethiopia for around one month. Once care mothers return to their own communities, they’ll bring back the parent rootstock and educate their communities about enset through songs: at schools, town congregations, and churches. Spreading information to local communities through songs has been done previously by the International Fund for Agricultural Development (IFAD), which successfully promoted HIV awareness. In addition, care mothers are

responsible for creating and selling various enset products, such as selling *kocho* to local bakeries as an alternative to wheat bread.

This way, by local influence, we will be able to spread information about enset's potential to different agricultural communities in need of a stable, nutritious, and high-yielding crop, and ultimately bring income to many vulnerable Mozambican women and their children. Employing care mothers is important in combating Mozambique's misogynistic society: with little access to education and little opportunities available for girls. Many women marry and give birth young, and are forced to stay at home. Those who are employed often work in agriculture, but are severely underpaid (Pswarayi-Riddihough).

Due to Mozambique's current instability, implementation using outside aid is optimal. Funding and planning for implementation of enset could potentially come from organizations like the European Union (EU). The EU has previously funded a project by the Food and Agriculture Organization of the United Nations (FAO), which has done projects to promote nutrition and gardening in Mozambique, potentially employing 30,000 care mothers ("Nutrition Comes From Gardens"). This project has demonstrated the success of care mothers: changing the behavior of affected communities and, subsequently, improving the nutrition and gardening habits of participating communities directly from the communities' roots - the mothers. Other organizations, such as the World Food Programme, have created initiatives in order to improve Mozambique's food systems by distributing seeds and agricultural kits to communities.

This growing wheat crisis has shown that Mozambique needs a sustainable, stable, and high-yielding food system in order to support its people from natural disasters, climate change, food insecurity, malnutrition, and dependency on imported wheat. Implementing the wonder crop enset via care mothers will not only benefit its environment but also the challenges of gender inequality.

Works Cited

- “Agriculture Sector in Mozambique.” *Energypedia*,
https://energypedia.info/wiki/Agriculture_Sector_in_Mozambique.
- “Average Household Size in Mozambique.” *ArcGIS*, 5 July 2013,
www.arcgis.com/home/item.html?id=1a85d81f75044c1b8cf0abf5e69fc0f2.
- Berhanu, Hanna, et al. “Characterization of Crop Residues From False Banana /Ensete Ventricosum/ in Ethiopia in View of a Full-resource Valorization.” *PLOS ONE*, vol. 13, no. 7, Public Library of Science, July 2018, p. e0199422. <https://doi.org/10.1371/journal.pone.0199422>.
- Blanchemain, Isabelle. “Wheat in Mozambique | OEC.” *OEC - the Observatory of Economic Complexity*, oec.world/en/profile/bilateral-product/wheat/reporter/moz.
- Borrell, James S., and Olef Koch. “The 'False Banana' Feeding Millions.” *Kew*, 21 Jan. 2022,
<https://www.kew.org/read-and-watch/enset-false-banana>.
- Borrell, James S., et al. “Enset in Ethiopia: A Poorly Characterized but Resilient Starch Staple.” *Annals of Botany*, vol. 123, no. 5, Oxford UP, May 2019, pp. 747–66. <https://doi.org/10.1093/aob/mcy214>.
- “Chapter 5 : Food Security” *Special Report on Climate Change and Land*, www.ipcc.ch/srccl/chapter/chapter-5.
- “Climate-Smart Agriculture in Mozambique.” *Climate Knowledge Portal*,
climateknowledgeportal.worldbank.org/sites/default/files/2019-06/CSA-in-Mozambique.pdf.
- “Education.” *U.S. Agency For International Development*, www.usaid.gov/mozambique/education.
- “Ethiopian Crop ‘Enset’ Identified as Climate Coping Strategy in Drought-Prone Regions.” *Phys.org*, 23 Nov. 2022, phys.org/news/2022-11-ethiopian-crop-enset-climate-coping.html.
- Fawzy, Mary. “These Are Mozambique’s Must-Try Dishes.” *Culture Trip*, 17 Mar. 2020,
theculturetrip.com/africa/mozambique/articles/these-are-mozambiques-must-try-dishes.
- “Find a Job in Mozambique and Learn What Working Here Is Like.” *InterNations*, 10 Feb. 2023,
www.internations.org/mozambique-expats/guide/working-short.
- “Global Health.” *U.S. Agency For International Development*, www.usaid.gov/mozambique/global-health.

“Government.” *Commonwealth of Nations*, 8 May 2013,

www.commonwealthofnations.org/sectors-mozambique/government.

“Industrial Agriculture And Small-Scale Farming.” *Global Agriculture*,

<https://www.globalagriculture.org/report-topics/industrial-agriculture-and-small-scale-farming.html>.

“International Fund for Agricultural Development (Mozambique).” *Development Aid*, 25 Mar. 2022,

<https://www.developmentaid.org/donors/view/414559/ifad-international-fund-for-agricultural-development-mozambique>.

Jett, Dennis. “Mozambique Is a Failed State. Western Donors Are Helping Keep It That Way.” *Foreign Policy*, 7

Mar. 2020, foreignpolicy.com/2020/03/07/mozambique-is-a-failed-state-the-west-isnt-helping-it.

Lakhani, Nina, et al. “Our Food System Isn’t Ready for the Climate Crisis.” *The Guardian*, 19 Apr. 2022,

www.theguardian.com/food/ng-interactive/2022/apr/14/climate-crisis-food-systems-not-ready-biodiversity.

Lakhani, Nina. “The Race Against Time to Breed a Wheat to Survive the Climate Crisis.” *The Guardian*, 12 June

2022, www.theguardian.com/environment/2022/jun/12/wheat-breeding-climate-crisis-drought-resistant.

“Malnutrition in Mozambique.” *The Borgen Project*, 30 Nov. 2017, borgenproject.org/malnutrition-mozambique.

“Map of Mozambique, Africa.” *Nations Online*, www.nationsonline.org/oneworld/map/mozambique_map.htm.

Marie, Adriane. “Wheat Benefits, Side Effects: Is Wheat a Vegetable? Vegan?” *HEALabel*, 20 Jan. 2023,

<https://www.healabel.com/wheat-benefits-and-side-effects/>.

“Mozambique.” *AFS*, www.afsusa.org/countries/mozambique.

“Mozambique.” *Press Reference*, <http://www.pressreference.com/Ma-No/Mozambique.html>.

“Mozambique.” *The World Factbook*, Central Intelligence Agency,

<https://www.cia.gov/the-world-factbook/countries/mozambique/>.

“Mozambique Country Profile.” *BBC*, 17 Jan. 2020, www.bbc.com/news/world-africa-13890416.

“Mozambique.” *UNESCO IBE*,

http://www.ibe.unesco.org/fileadmin/user_upload/archive/Countries/WDE/2006/SUB-SAHARAN_AFRICA/Mozambique/Mozambique.htm.

“Mozambique - Healthcare.” *International Trade Administration* | *Trade.gov*,
www.trade.gov/country-commercial-guides/mozambique-healthcare.

“Mozambique” *OECD*, oec.world/en/profile/country/moz.

FAOSTAT. www.fao.org/faostat/en.

“Mozambique: The Gateway to Africa.” *Miller*, 14 Dec. 2017,
millermagazine.com/blog/mozambique-the-gateway-to-africa-2539.

“Mozambique: Three Billion Meticaís for Agricultural Research.” *Club of Mozambique*, 1 Sept. 2022,
clubofmozambique.com/news/mozambique-three-billion-meticaís-for-agricultural-research-224032.

“Mozambique: World Food Programme.” *UN World Food Programme*, World Food Programme,
www.wfp.org/countries/mozambique. Accessed 29 Aug. 2023.

Mwemedi, Juliana *Mozambique* | *WaterAid UK*. www.wateraid.org/us/where-we-work/mozambique.

“Nutrition Comes From Gardens.” *Food and Agriculture Organization of the United Nations*,
www.fao.org/fao-stories/article/en/c/1099430.

“Provinces of Mozambique.” *M.Info*, <http://www.mozambiqueinformation.com/provinces-of-mozambique.html>.

Pswarayi-Riddihough, Idah Z. “Time for Bold Action to Advance Gender Parity in Mozambique.” *World Bank*,
World Bank Group, 8 Mar. 2021,
<https://www.worldbank.org/en/news/opinion/2021/03/08/time-for-bold-action-to-advance-gender-parity-in-mozambique>.

Reid, Kathryn. “1980s Ethiopia Famine: Facts, What’s Changed, and How to Help.” *World Vision*, 3 Nov. 2022,
www.worldvision.org/disaster-relief-news-stories/1980s-ethiopia-famine-facts.

Ricaldi, Federica, and Christopher Delgado. “More and Better Agriculture Jobs in Mozambique Desperately Needed, but Not Certain.” *World Bank Blogs*, 1 June 2023,
blogs.worldbank.org/jobs/more-and-better-agriculture-jobs-mozambique-desperately-needed-not-certain

Rosane, Olivia. “Ethiopia's Banana-like Enset Is Potentially a Climate Superfood That Can Reduce Global Hunger.” *Treehugger*, *Treehugger*, 2 Feb. 2022,
<https://www.treehugger.com/ethiopian-banana-climate-global-hunger-5217741>.

- Rummel, Rachel. "Enset: The False Banana." *Atlas Obscura*, Atlas Obscura, 15 Sept. 2017,
<https://www.atlasobscura.com/foods/enset-kocho-ethiopia>.
- "Rural Population Percent of Total Percent." *Mozambique - Rural Population - 2023 Data 2024 Forecast 1960-2021 Historical*,
<https://tradingeconomics.com/mozambique/rural-population-percent-of-total-population-wb-data.html>.
- Russo, Frank. "How Much Does the Average American Make in 2022?" *First Republic*, 7 Dec. 2022,
<https://www.firstrepublic.com/insights-education/how-much-does-the-average-american-make>.
- Seeley, Elena, et al. "Enset: Ethiopia's Ancient Solution for Soil Health." *Food Tank*, 2 Dec. 2016,
<https://foodtank.com/news/2013/09/enset-ethiopias-ancient-solution-for-agricultural-sustainability/>.
- "Ukraine May Supply Wheat to Mozambique." *Club of Mozambique*, 19 Aug. 2022,
clubofmozambique.com/news/ukraine-may-supply-wheat-to-mozambique-223355.
- "Telecommunication in Mozambique." *Worlddata.info*,
www.worlddata.info/africa/mozambique/telecommunication.php.
- "The Food, Fuel, Finance Crisis: Mozambique Under the Spotlight." *HelpAge International*,
www.helpage.org/newsroom/latest-news/the-food-fuel-finance-crisis-mozambique-under-the-spotlight.
- Thelwell, Kim. "Top 10 Facts About Living Conditions in Mozambique." *The Borgen Project*, 16 May 2019,
borgenproject.org/top-10-facts-about-living-conditions-in-mozambique.
- "Wheat Crisis: MIC Suggests Substituting Bread With Local Products – Notícias." *Mozambique*, 7 June 2022,
www.africa-press.net/mozambique/all-news/wheat-crisis-mic-suggests-substituting-bread-with-local-products-noticias.
- World Bank Group. "Mozambique Gets \$150 Million for Rural Roads in Support of Agricultural Productivity." *World Bank*, 9 May 2018,
www.worldbank.org/en/news/press-release/2018/05/08/mozambique-gets-150-million-for-rural-roads-in-support-of-agricultural-productivity.

