

Brandon Stone
East Syracuse Minoa High School
Syracuse NY
Somalia, Factor 6: Sustainable Agriculture

Somalia: Identifying the Problem and Considering Sustainable Agriculture Practices

In the United States of America and a number of other countries around the world, people can jump in their cars and, within minutes, arrive at a supermarket. The supermarket offers several hundred food options from frozen pizza to exotic fresh fruits. Yet there are people in our world who struggle to fend off starvation. Famine in these parts of the world plagues development. The struggle to find enough food to survive consumes the daily lives of these people, particularly in “third world” countries. Food consumption is an obvious necessity for survival. Not everyone in the world has the luxury of nutritious food or access to daily food at all: “The Horn of Africa is one of the most food insecure regions in the world” (Food Insecurity in the Horn of Africa). More than 40 percent of the people in this part of the world are under-nourished, and in the country of Somalia, that percentage grows to 70. In other words, nearly three-quarters of the country’s population is malnourished or starving.

The Somalian people have few options for diversification because they are, largely, uneducated, and the basic skill set they hold—in terms of the entire population—involves agricultural production. Due to their transitional government and political and social instability, there are few opportunities for Somalis to branch out into other forms of employment. According to Michele Kelemen, NPR foreign desk correspondent, “Even now, we are fighting one of the world’s most formidable terrorist groups who are intending to destroy Somalia and use Somalia as a platform for destroying the world stability and world democracy” (Science in Context, “Africa Summit to Tackle Food Stability and Climate Change”). Kelemen addresses the impossibility of discussing government policies, including agricultural sustainability, in the absence of a real government.

“Many parts of central and southern Somalia have experiences extensive banditry and criminality due to the lack of any form of effective government. In these areas [sic] the provision of basic services has been totally dependent on international agencies and non-governmental organizations,” according to UNICEF document “Somalia Malaria Strategy: 2005-2010 (www.rollbackmalaria.org). This document supports the argument that the starvation of Somalis can not be effectively addressed until they have a functioning, centralized government. At this juncture, Somali government policies simply do not exist.

There needs to be viable alternative forms of sustainable agriculture for people faced with starvation every day. Aquaponics is an alternative food production method that uses aquaculture and hydroponics to grow both fish and crops in a single integrated system. “The hybrid nature of the system reduces maintenance and inputs cost while yielding equal or higher amounts of fish and crops than aquaculture and hydroponics alone (Nutrient recovery from in Fish Wastewater).” By changing the methods in which food is produced to gain more efficiency in water usage, vegetation and meat production, Somalia can grow economically and, more importantly, save lives. However, Somalia first needs a functioning government in order to establish policies and enact these types of alternative forms of food production.

Somali Development Indicators

The Somalian population is currently 10,428,043 people (World Fact Book). Polygamy is prevalent in Somalia although it is not always practiced (ethomed.org). According to Ethomed researchers, a relatively affluent man in Somalia can have up to 4 wives. The families do not always interact with one another. It is often common for there to be a single home where the families tend the livestock and farming together. Marriages are often arranged. The typical age for marriage is usually around fourteen or fifteen years. A woman begins bearing children shortly after marriage (ethomed.org). Although the average number of

children a woman bears is six, it is not uncommon for Somali women to have up to seven or eight children. A result of the lack of work and lack of food produced, men must travel to larger cities for work or to tend a large farm, not their own. This puts a strain on women who stay at home. Again, according to EthoMed, there have been no technological advancements to help women with their work, leaving them toiling endlessly, with no higher levels of income.

According to the World Fact Book, before the Somalian civil war of 2009, children started school around the age of five or six and attended four years of elementary school, four years of middle school, and four years of high school. Both private and public schools were available. Higher education was free. Unfortunately, post-war Somalia bears little resemblance to what would today be seen as an educational paradise. There are now only private schools available because the country cannot afford public school, and most families cannot afford private schools. Only 14-17 percent of children—almost all male—are enrolled in elementary school in Somalia. This is one of the lowest percentages in the world (World Fact Book). Higher education is available after high school, but only a tiny fraction of families can afford it. Consequently, literacy rates in Somalia are low. Out of the total 10,428,043 people living in Somalia, 37.8 percent of people are literate. Out of the men, 49.7 percent are literate. Literacy rates for women are extremely low at 25.8 percent (World Fact Book)

Farming is critical to the Somalian economy and the Somalian way of life. Out of the total Gross Domestic Product (GDP) of Somalia, 59.6 percent is related to the farming sector. Sixty percent of the 59.6 percent of farming is involved in livestock farming with the remaining percentage devoted to plant development. The GDP per capita is 600 dollars (Business Insider). The average family makes only 50 dollars a month, or 12.5 dollars a week, or 1.6 dollars a day (World Fact Book). Somalia land area is 627,337 sq km. Out of this area, only 1.73 percent is arable (World Fact Book). Of this small percentage of land, only .05 percent of crops grown are permanent crops (Pet-Crops Somalia). An example of a permanent crop is a vineyard because grape vines do not have to be replanted every year. Most of the crops produced in Somalia are mono crops, such as the crop maize. The main exports and highest profit of goods produced in Somalia are livestock, bananas, animal hides, fish, charcoal, and scrap metal (Business Insider). Agriculture production is divided between subsistence rain fed farming, often part of agro-pastoral production systems, with a typical size of 2-4 hectares, small-scale irrigation, and oasis farming. (Aquistat). Farmers live at subsistence levels, forming the regions' highest group of food insecure people. These farmers have few resources or assets and work far from markets (SATG.org).

Factors Limiting Agricultural Advancement

There are many factors that limit the improvement of agricultural productivity in this region of the world. One major problem that is associated with Somalia's lack of agricultural advancements is deforestation. The process of making charcoal in Somalia causes deforestation. Charcoal production involves massive burnings. In addition to destroying trees, these burnings break down soil composition, making it un-arable. It also wipes out other forms of vegetation. Concurrently, vehicles that carry charcoal damage pasture land in transit, creating hundreds of dusty and useless tracks which end up as eroded gullies after rains (Environmental Degradation in Somalia). Somalia has never recovered from the drought in 2010. Out of the total amount of land possessed by Somalia only .3 percent is irrigated. This makes large scale farming inappropriate for Somalia. According to a CNN reporter, "At the peak of the crisis, between May and August 2011, famine and severe food insecurity claimed some 30,000 lives a month... October 2010 to April 2012, suggests that an estimated 4.6% of the total population and 10% of children younger than 5 died in southern and central Somalia" (CNN). The year from July 2010 to 2011 was Somalia's driest in 60 years. This resulted in the die-off of livestock, small harvests, and a big drop in demand for labor, due to lack of productivity. The decrease in productivity caused wages to plummet, lowered the national GDP, and sent the country into crisis: 258,000 Somalis died (CNN). According to U.S.-based Famine Early Warning System Network, there had been double the amount of deaths than the worst case scenario

predictions. (Los Angeles Times) Because there is lack of functioning, centralized government, there has been little input from leadership to improve pastoral systems. When Somalian organizations do attempt to fix a problem, they inadvertently have done more harm than good (Food insecurity in the Horn of Africa). With around 60 percent of the national GDP coming from agriculture, and there are many factors limiting the effectiveness of agriculture; it is no surprise that Somalia is one of the poorest and least well-off countries in the world. Unfortunately, the most important agricultural areas are located in south Somalia where much of the fighting has taken place, making production next to impossible. Somalia does, however, have a vast array of fisheries available off of their coast. Yet these fisheries are being overrun by pirates, so it is dangerous to extract fish.

There have been problems in Somalia in getting the required aid to people who most need it. These problems stem from the Islamic militia known as the Shabab (Los Angeles Times). Shabab has denied humanitarian access to areas in dire need of assistance. They prevented people from leaving, and local warlords stole aid that was meant for civilians. This theft has created problems with American intervention. The United States stopped aiding Somalia largely because of the presence of Shabab. It is against American counter-terrorism law (which has imposed sanctions restricting the transfer of aid that goes into the hands of terrorist groups). "In January 2010, the World Food Program suspended aid to southern Somalia, after reports that the Shabab was diverting supplies." According to *Los Angeles Times* reporter, "Everyone wanted to get aid in... Somalia was an accountability-free zone. You could not count on getting aid to the people who needed it most." Americans should be involved in Somalia, and we have to means of helping them create a stabile government, limiting corruption and Somalian piracy. Improving conditions in Somalia will also benefit Americans sailing the waters.

Factor Selected: Sustainable Agriculture

In Somalia, there is a continual struggle to have enough food for one day. Somalia has been dealing with famine for much of its history. When droughts hit, Somalia moves into extreme crisis. Famine also struck Somalia in the 1990's. Somalia, like the patient in the emergency room, moves into critical condition when a drought hits, and deaths reach genocidal levels.

Preventing Sustainable Agriculture

Lack of protein from food sources, lack of vegetation being produced, lack of needed arable land to encase vegetation production, and lack of available water make it almost impossible for Somalia to sustain agricultural production. This leads to the question, what project can encompass solutions to every one of the problems identified in this position paper? One possible answer is aquaponics.

With the help of the Clean-water Education Research Facility in Minoa, I created an aquaponics system. By definition, aquaponics is the farming of fish and plants with a symbiotic closed system which, in turn, purify the water. In order for a technology to be successful in developing nations, it must be affordable, have a low maintenance cost, and must protect the nation's natural resources. We made our system out of materials that are inexpensive in order to resemble the funding that would be available if we were to implement this system in a third world country, such as Somalia. One notable difference between the system I created and the one that would be built in Somalia involves the pump used to transfer water. Alternatively, a siphon-discharge setup is one in which water is taken from a locally available source (river) and discharged back into the river after being processed; however, this set-up is more common for large scale operations in the attempt to ensure water quality. In Somalia, it is possible to reproduce the results of the siphon-discharge set-up with a simple windmill that is wind-powered, acting like a pump. The windmill would connect to tubes and send the water from the effluent bottom box to the top boxes. There should be two 55 gallon barrels and three boxes where plants are being grown. In one of the barrels, there should be fish. The fish produce ammonia when they excrete. The autotrophic bacteria act as biological filters in the system and break down the ammonia and convert it into nitrates and nitrites.

The nitrites and nitrates, once broken down, act as minerals for the plants and promote growth. The nitrates and nitrites from the barrel with the fish are pumped to boxes one, two, and three. The process of nitrification can be seen in the experiment through testing. On 8/4/14, there was approximately 1.38 NH₃ (mg/l) and 2.9 (NO₃)¹⁻(mg/l). This was the first day that the system was operating. On 8/31/14, there was .07 NH₃ (mg/l) and 1.84 (NO₃)¹⁻ (mg/L). These factors show that we were able to manipulate the system to produce more nitrates and remove ammonia from the system. Naturally, there will be oscillation between ammonia and nitrates. This knowledge can be applied to a system to better sustain plant growth. Our system contains a unique fix of three different boxes with three different aggregates. The boxes are in a tiered system, and they are extremely space efficient.

The goal of my research was to determine whether or not the type of aggregate in which the plants grew affected their growth. We tested aggregates of limestone, bedrock, and andesite. Limestone was expected to have the least amount of plant growth because of its alkalinity and chemical composition of CaCO₃. Andesite was expected to have the most amount of plant growth because it is composed of mainly carbon. After the boxes were seeded with peas, tomatoes, okra, and carrots, testing began. The pH of the limestone box was high, averaging around 8.6 pH. Surprisingly, however, plant growth was noticeable and sustained. In every box, the tomatoes died off as expected, most likely due to the high pH running through the system. In the box with andesite, Okra and peas grew the best. The carrots died off. In the box with the bedrock, there was not much growth at all. Only the peas began to grow then died off. In the box with limestone, peas grew rapidly with growth in the okra. This is most likely due to the nitrification process. The limestone box consistently had the rate of lowest ammonia with the highest amount of nitrates. At the beginning of the experiment, there was an initial jump in pH of the limestone effluent because of limestone dust being mixed in with the water; nevertheless, the plants were able to get the most amounts of nutrients in the limestone box. There were discrepancies in the amount of nitrification because of the aggregates that were being used in the system. Limestone was the most efficient at creating the biological filters needed to initiate the nitrification cycle and grow.

I propose that implementing aquaponic systems throughout Somalia has the potential to solve the country's ongoing struggles once there is governmental backing and stability. Aquaponic systems are environmentally friendly using water more efficiently than agriculture. Aquaponic systems use around 90 percent less water than conventional farming techniques (Department of Agriculture, Bangladesh). Water cycles throughout the system. If evaporation is a problem because of extreme heat and humidity, there are covers that can be placed on the top of the barrels to compensate. Aquaponic systems also address the lack of arable land available in Somalia because aquaponic systems require no arable land. The tiered system I collaboratively designed saves space with its compact vertically structure. The three box setup also improves yield of vegetation. I tested three different types of rock and obtained three different types of results. Limestone, available in Somalia (Nutrition Country Profile Somalia), was the rock that gave the best results. Using this design, Somalis can test other rocks and minerals available to them to get the best harvest possible. The aquaponics system also grows fish. With aquaponics, the fish can safely grow and reproduce. Having quantities of fish available will increase the protein, meat, and overall food deficiencies presently plaguing Somalia.

If aquaponics were implemented in Somalia, there would be an increase in their GDP, fewer deaths, and overall better living conditions. As stated before, about 60 percent of Somalia's GDP comes from agriculture. This solution is supported through the previous knowledge that Somalis have of agriculture. I contend that implementing aquaponics in Somalia will increase the amount of meat and vegetation produced. There will be more fish to eat and more plant products to sell. If the average person is making 600 dollars a year, and 60 percent of that comes from agriculture, than 360 dollars each year per person is from agriculture. If I am correct that aquaponics will increase the amount of agriculture being produced, then it dramatically can affect the GDP of every farming Somali. Currently, there is no noticeable research or articles found on aquaponics in Somalia where sustainable agriculture is not

practiced. Farmers tending their private gardens are not producing enough for profit. Somalia currently relies on foreign aid to supply food and resources. If the Somalis cannot begin practicing sustainable agriculture, relying on foreign aid will damage their GDP and produce no long-term solutions. Somalia is currently under great economic strain, and sustainable agriculture is one possible answer. Aquaponics will help the global water scarcity that is also very prevalent in Somalia because of its efficiency. An aquaponics system requires only the initial water input. Biologically contaminated water also works for this system because of the biological filters and the nitrification process. Water is purified by the plants and renewed as the system maintains itself. This system also increases the efficiency of plant growth. This system is ideal for a growing population. It takes up very little room relative to farming and even other aquaponic systems because of its tiered design. This system will help feed more people.

Somali Projects

In Somalia, there is currently an organization called SATG (Somali Agriculture Technical Group), a nonprofit organization that works to rebuild agricultural practices by educating Somalis on agricultural techniques. SATG recognizes the importance of agriculture to Somalia (SATG.org). Bringing the idea of an **aquaponics** system to SATG would be one way of working with a current organization. Considering the weak government, it is important to implement sustainable agriculture through community or Non-Governmental Organizations (NGOs). Large scale investment such as roads and ports will always be important; however, the NGOs should start on the small scale in response to local needs. There should be a central role for local organizations like NGOs, farmers' associations, and community-based groups. Women should also be given equal voices in decision making. Commitment of all partners at the local and external levels should be long term and span, "longer than a typical development project" (The Elimination of Food insecurity in the Horn of Africa). The strategy taken by all partners should be to "broaden opportunities for sustainable livelihoods, protecting the most needy, and creating an enabling environment for reducing food insecurity and poverty" (The Elimination of Food insecurity in the Horn of Africa). Other organizations that could be involved are Food Security and Nutrient Analysis Unit for Somalia (FSNAU), a project managed by the United Nations Food and Agriculture Organization (FAO). These organizations could have success in Somalia because they have large staffs and could assist Somalia in making internal improvements, as well as giving agricultural aid. There should be a larger effort to implement sustainable agriculture that could, potentially, hire workers. This would most likely bring the highest yield of crops by combining intelligence, labor, and space. There also needs to be ways in which Somalia can engage in the technologies associated with the "green revolution." Agriculture productivity must be increased in areas where there are low levels of rainfall. In areas with higher rainfall, there are hybrid seeds and fertilizers available. Drought-prone areas need to have technologies designed to increase their yields (Food Insecurity in the Horn of Africa).

Conclusion

World population continues to grow, and we must deal with the reality of the problems caused by this growth. We must change our practices to account for all the new inhabitants. In Somalia, there have been catastrophic events that have caused thousands of deaths. People in Somalia are dying because there is not enough food for the Somalis. When a drought or natural disaster hits, it sends the already weakened country into catastrophe. There needs to be a way for Somalia to have preparedness for droughts. The focus for the near future should be placed on increasing resources for poor farmers through the enhancement of agricultural technologies. "By converting nutrients into biomass, treating wastewater could become a profitable business in third world countries" (Nutrient Recovery from in Fish Farming Wastewater). Implementing an aquaponics system is just one way to increase the average crop yield to eradicate extreme poverty and hunger and will help to reduce child mortality by increasing the amount of protein and meat available: growing fish, and ultimately increase the per capita GDP of individuals in Somalia, leading to better living conditions and a healthier country.

Works Cited

- The World Fact Book. (2014, January 1). Retrieved September 8, 2014, from <https://www.cia.gov/library/publications/the-world-factbook/geos/so.html>
- Wagah, M. (2005, January 1). Nutrition Country Profile Somalia.
- Jones, B. (2013, July 19). THE WORST PLACE IN THE WORLD: See What Life Is Like In Somalia. Retrieved September 8, 2014.
- Smith-Spark, L., Mogadishu, N., Wrote, L., Reported in London. Alexander Felton, & Brumfield, B. (1970, January 1). Somalia famine killed close to 260,000 people, report says. Retrieved September 8, 2014.
- Environmental degradation in Somalia. (n.d.). Retrieved September 8, 2014. <http://www.tiempocyberclimate.org/portal/archive/issue26/t26art1.htm>
- Encyclopedia of the Nations. (n.d.). Retrieved September 8, 2014. <http://www.nationsencyclopedia.com/economies/Africa/Somalia.html>
- Cousin, Tracey L. "Somalia: The Fallen Country." ICE Case Studies. <<http://www.american.edu/projects/mandala/TED/ice/somwar.htm>> . Accessed September 200
- Somali Cultural Profile. (n.d.). Retrieved September 8, 2014, from <https://ethnomed.org/culture/somali/somali-cultural-profile>
- Status, Roles, and Prestige, added March 2009, written by Jessica Mooney and Gillian Shepodd. It is based on information contributed by eight members of Seattle's Somali community and was reviewed by a Somali medical interpreter at Harborview Medical Center.
- Death and End of Life Issues and Bereavement and Grief, added March 2009, written by Jessica Mooney and Gillian Shepodd. It is based on information contributed by eight members of Seattle's Somali community and was reviewed by a Somali medical interpreter at Harborview Medical Center.
- Robinson WI (2010) PET-Crops Somalia: A Pictorial Evaluation Tool for Crop Assessment in Somalia, AA International Ltd, Aberystwyth.
- "Somalia." AQUASTAT. Web. 9 Sept. 2014.
"Food Insecurity in the Horn of Africa."The Elimination of Food Insecurity in the Horn of Africa. Web. 9 Sept. 2014.
- <Sharior Hashem, Nutrient Recovery from in Fish Farming Wastewater: An Aquaponics System for Plant and Fish Intergration. Publications, IDOSI, 2014. World Journal of Fish and Marine Sciences.>
- Dixon, Robyn. "U.S. Policy Seen as Factor in Somalia Famine Deaths." Los Angeles Times. Los Angeles Times, 2 May 2013. Web. 19 Sept. 2014.
- Capobianco, Emanuele. "Somalia Malaria Strategy 2005-2011." 1 Jan. 2005. Web. 19 Sept. 2014.
"African Summit to Focus on Terrorist Threat." VOA. Web. 19 Sept. 2014.