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The Republic of Zambia, Factor 11: Malnutrition

Zambia is a beautiful country with a fascinating shape. Formerly known as Northern Rhodesia, it gained independence from Great Britain in 1964. This landlocked African country is about the size of Texas, bordered by Malawi, Namibia, Tanzania, the Democratic Republic of the Congo, Zimbabwe, and Mozambique. The country's population is highest in the Copperbelt province and the area surrounding Lusaka, the capital and largest city. Zambia covers 752,614 square kilometers, which makes it the 39th largest country in the world.(CIA) The currency is the Zambian kwacha. 5249.4108 kwacha equals \$1 USD, or, 1 kwacha equals .00002 USD.(Sawe)

It's unique flag is a green field with a panel of three vertical stripes, red, black, and orange in the lower right side, directly below a soaring eagle. The green represents the country's abundant natural resources and vegetation, red is the struggle for freedom, black stands for the the people of Zambia, and orange stands for the country's mineral wealth; the eagle represents the people's ability to rise above their country's problems. (CIA)

The official language is English, however, in rural villages, tribal languages are also spoken. All of Zambia's major languages are members of the Bantu family. (CIA) One of the many great things about the different tribes in Zambia is that they do not fight. They sometimes even marry outside their own tribe, and through that they continue to strengthen their bonds. The choice of tribes to co-exist peacefully is one of the many positive qualities of Zambia.

It has a tropical climate, and two seasons: the rainy season from November to April, and the dry season that lasts from June through October. Zambia has 14 ecosystems in four categories, grassland vegetation, thickets, woodlands, and forests. The following regions are considered most notable. The Zambebian Cryptosepalum Dry Forests are thick forests on the western side of Zambia with a tropical climate. These forests are drained by the Kabompo River, which explains the sandy soil. Wildlife poaching is still a threat in this region, even in protected areas. The next region is The Central Zambebian Miombo Woodlands, and the northern part of Zambia is included in this region that also stretches across neighboring countries. The region has poor soil, a tropical climate, and long dry seasons that last about seven months. Hunting and poaching are the most common wildlife threats. Fires and clearing land for settlement are also common. The third region is the Southern Miombo Woodlands, which is mainly in the southern part of Zambia and is flat with inselberg formations. This has a tropical savanna climate and is home to a variety of wildlife. This has seen continued change: trees are being cut for fuel, overgrazing has destroyed most of the underneath vegetation, and much of the area has been cleared for cultivation.(Sawe)

It is the second largest copper producer in Africa, behind the Democratic Republic of the Congo, but over-reliance on that makes it vulnerable to when commodity prices drop. This was especially noteworthy in 2015 when there wasn't as big of a demand from China.(BBC)

Having one of the world's most rapidly growing populations, the UN predicts it will triple by 2050. Unfortunately, even with continued economic growth and investment from the Chinese, two-thirds of Zambians still live in poverty. (BBC) In addition to unemployment, it is not surprising that food

insecurity and undernutrition, as well as chronic poverty continue to create ongoing challenges. These problems are compounded by significant HIV/AIDS prevalence. In 2015 it was estimated that 1,211,900 people were living with HIV/AIDS. (CIA) In Alan Whiteside's book, *HIV & AIDS A Very Short Introduction*, he calls this a "poor man's disease." He also states that although we are closer to a cure, treatment is costly. He writes that it is, "a unique and dynamic disease with long-term consequences." (book HIV & AIDS A Very Short Introduction, by Alan Whiteside Second Edition 2016)

Free healthcare was adopted in the 1970's. Implementing this was a step in the right direction, but there remains much work to be done. Services suffer because of a severe shortage of doctors and specialist staff. An exciting program called "Virtual Doctors," founded by Huw Jones, is a program that utilizes volunteer doctors in Great Britain to provide direct support to workers in rural health centers without doctors. Staff in clinics send details of symptoms to the doctors to get immediate assistance. It is a great opportunity to utilize technology to provide important health care services. (BBC)

Public school is free and mandatory for grades one through seven, and children begin about age seven. The school year runs from January to December and is divided into three terms. At the end of primary school students sit for a test before moving on to secondary education. This is divided into two phases: lower secondary which lasts two years and upper secondary which is three years. Most schools require uniforms, but uniforms and supplies can create a burden for families since many are very poor. Many of the schools are underfunded and often lack necessary facilities and teachers, which can contribute to a substandard education. This is often worse in rural areas. Also, extreme poverty, especially in rural areas, drives many children out of school, which leads to children living on the streets.

(<http://www.expattarrivals.com/zambia/education-and-schools-in-zambia>) Zambia is ranked thirteenth highest of the countries in Africa, 71% of adults,(age 15+) and 75% of young adults, (age 15-24), can read and write. (UNESCO)

Currently, the staple food of the country is maize, called nshima. For breakfast it is made into a thin porridge. For lunch and dinner it is a thicker consistency and often served with relish. Additional foods include ifisash, which is green vegetables in peanut sauce, and samp, crushed maize and beans. (Our Africa) There is clearly a need for protein.

Addressing food insecurity, especially adding or even increasing protein, as well as creating diet diversification is a quality of life issue that must remain a priority. Zambian families, especially children and pregnant or nursing mothers, need to have access to diverse and quality food, along with clean water and safe sanitation. This paper will address a way to improve food quantity and quality for all the people of Zambia, regardless of where they live. The use of aquaponics, being versatile enough to fit all terrains, space constraints, and socio-economic levels, has the potential to transform the health and financial well-being of the entire country. Adequate and continued support, both educational and financial, from combined government and non-governmental organizations cannot be understated. Careful and deliberate planning and preparation by a carefully selected team that includes local leaders from both rural and urban communities is a crucial component.

Establishing aquaponics systems in Zambia would require a lot of planning and decision-making in addition to education and training. USDA is an example of a good source for providing both information and specialists to assist in that process. Iowa State University is another good resource to consider.

Successful aquaponics implementation in Zambia, initially targeting subsistence farmers, with consideration for expansion to ultra-poor urban dwellers requires a specific training program with qualified trainers or educators. This would require people and programs to provide initial training as well as guidance for startup and ongoing needs. A plan for gradual independence, with more limited support would be an important part of this plan. An advisory group of local people who might help choose participants who will start using the aquaponics systems would be important in the beginning. Another component for success could be the use of video conferencing systems such as Skype, UberConference, or one of the many other video conferencing systems.

Addressing infrastructure needs, such as roads for transporting excess fish and vegetables to market need to be considered. Energy to operate the system is another important aspect that needs to be consideration. Although the county has energy from hydropower being able to effectively get that energy needs to be examined. Things such as wind or solar energies could be a solution to provide energy for the pumps to run. Generators are another option but getting fuel to the farm and the price of fuel could create problems with this option. It would be a good idea for farmers to have a generator as a backup in case something would go wrong.

Restocking and replacing fish aquaponics system parts and equipment, as well as fish food and the fish and plants to use in their systems are key ongoing components for success. Farmers need to know how to repair and also when to replace their equipment. Creating local shops to supply materials to keep up with farmers needs would create additional employment for people who own and work in the shops. Making sure there are suppliers to get materials to Zambia, and also will continue to provide for user needs must to be addressed before construction of any aquaponics systems start. One way is to provide incentives for companies to send supplies. Guaranteeing that there would be a demand for a constant flow of supplies could be one incentive. Another might be that they would become the sole supplier for a set number of years.

There are different hydroponic and aquaponics systems that can be considered for use, many will work but the system that will work the best is the tower system. There are many towers on the market, and the more you read about the more difficult it becomes to determine which would be the best for different locations. A brief discussion about towers, is that all of them allow for more air around the plant roots, keeping them healthier. It would be interesting to experiment with installing towers out of different materials to determine the most efficient. Plastic would be durable, while local trees or other renewable resource materials might be better suited for the towers. This issue could be complicated by deforestation, and proper steps and resources would need to be carefully considered. Ideally, it seems it would be great if utilizing local trees in conjunction with a reforestation program could be implemented to help the country and for use in aquaponic systems. The tower system is a technique where plants are grown vertically in tubes and water is pumped above the plants and then released down the tube. This method is also very efficient in conserving water. The main reason for the loss of water is the water that is lost by the plants themselves. On average you only will lose about one percent of your water. "This means that on a 4,000 gallon tank you will only lose about 40 gallons a day." (Baptista) This seems like a lot of water

but your plants are what will be using most of it. This is called evapotranspiration. There is also no way to stop it because it is necessary for plants to do this. The other way that you can lose water is through leaks in your system, and although these are uncommon they can happen. Even looking at how the zipgrow system can lose water it still saves water over traditional farming practices in the long hall because traditional farming practices can use 20 times the water of a circulating system like a zipgrow system. (Baptista) It can also help conserve local water supply, since there is less waste than conventional farming practices that are usually used in these to grow crops. Another advantage to this is that you can put a lot of towers into a small area. They do not take up very much room because they are vertical pipes. This means that the farmer can produce more vegetables than he needs, even providing additional vegetables for extra income to expand his operation. This can mean that he might be able to hire people around him and help them as well. Attention to the detail of whether there is any effect on the fish with differing vegetable growing methods must be considered.

Tilapia are frequently used because they are hearty and grow rapidly. The amount of space for the fish is a key component in determining the number of fish farmers could raise and also type of system used. This would have to be very individualized. An initial goal would be to provide much needed protein to feed your family. A long-term goal would be to raise enough fish to sell.

It seems that grow tubes often use red worms to tunnel for aeration.. (www.greenimager.com) This is something to consider when setting up each system. If that is beneficial, should a worm farm be established onsite or would it be more efficient to have them in a central location? (Baptista) Careful consideration should be given to worms that are most readily available to Zambia.

These towers have many names such as zip towers, vertical towers, and vertical hydroponics. There are many things that need to be considered when starting one of these systems. The temperature that is best for plant growth is between 70 and 75 degrees. It can also vary between 60-80 degrees but it is best to have it between 70-75 degrees. It is also very important that the temperature remains as stable as possible. (Hydroponics Towers)

Managing the pH is an important aspect of growing in these systems because different plants need different pH. The pH can not be too high or low because the fish will not be able to survive in the water. It is also important that the initial water is clean and somewhat purified. Maintaining water that is the correct pH, in addition to clean and purified is a vital component to insure that your plants and fish to survive. (Hydroponics Towers)

Depending on the size of the house that you have and the materials that are available you may need to use artificial light such as grow lamps. Glass could be difficult to transport, particularly in large quantities, where these system could be in place. It would be beneficial to explore the use of alternate materials, such as plexiglass. Also depending on the time of year, plants need 10 to 12 hours of light. If there is not

enough light in the day you would need to substitute with a grow lamp in order to get the 10 to 12 hours of recommended light that the plants will need each day. Grow lamps vary in price. There are also numerous options for length and number of tubes. The energy source to power the grow lamps should certainly be considered.

In conclusion, the use of aquaponics is an exciting method to wage war on the growing problem of malnutrition in Zambia. It can be successful in both urban and rural settings. The individual systems can be adapted to location and need. Providing healthy and adequate food for a growing population will require time and work, but it can be accomplished. Aquaponics is a viable solution to end malnutrition in Zambia.

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