

Team 3: Irrigation in Burkina Faso

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Final Paper

4/21/2014

How Might We:

How might we aid in creating sustainable irrigation systems in Burkina Faso?

The Problem:

Problem Statement and Significance:

Irrigation is a very helpful technology that can help to increase crop yields in virtually any climate or situation. There are many developing regions in the world that would benefit greatly if they have access to and the ability to operate sustainable irrigation technology. Ultimately this technology has the ability to provide more food security and reduce labor time for watering crops (giving people affected by this problem more time for other activities). Upon establishing our problem of a lack of sustainable irrigation technology we researched to learn more about regions that were particularly in need of sustainable irrigation technology. The nation of Burkina Faso is an extremely arid nation located partly within the Sahel region of West Africa [1]. This region is currently undergoing the process of desertification, precipitation is scarce outside of a rainy season in May [2]. In addition to these issues the region is extremely poor, with a GDP of 10.19 billion (USD), which makes up 0.02% of the world market [3]. This level of poverty makes technology access and technological know-how scarce. These are two problems that have made traditional solutions to the problem of a lack of sustainable irrigation systems in Burkina Faso. Traditional solutions to this problem usually rely on bringing in professionals with technology to set up drip-irrigation systems in villages. The problem with this type of solution is the ultimate lack of technological know-how (education on how to utilize the system) and the villagers' inability to repair systems when an issue presents. Therefore, we propose the use of an experimental study to aid in determining the best sustainable irrigation system for the people of Burkina Faso, in hopes to increase their crop yields. This experimental study will focus on determining the most efficient system for use in a village in Burkina Faso, in hopes that sustainability in irrigation can be achieved for the people of Burkina Faso. If this problem remains unsolved it can be predicted that the people of Burkina Faso will continue to experience food insecurity and struggle to increase crop yields, which is especially detrimental since population continues to rise [4]. Ultimately this will mean that Burkina Faso is unable to experience development, as people will not have their physiological needs met and therefore will be unable to perform other tasks to strive for development or education []. We hope that through providing an experimental efficiency study we will be able to aid the people in moving closer to a more developed nation.

Context of the Problem:

Working in an underdeveloped region adds numerous challenges to an already difficult problem. In Burkina Faso, the primary barriers are corruption, lack of infrastructure, lack of resources (capital), and cultural barriers. Corruption in the government reduces the resources available to humanitarian aid. Several different avenues and agencies that potentially could exploit humanitarian aid groups, thought this is usually a smaller scale issue [4]. On a larger scale, the government does not use aid money to support sustainable irrigation efforts, they concentrate much of their aid money to nutrition and economic recovery [5]. Lack of infrastructure also complicates the situation in Burkina Faso. Without substantial transportation infrastructure or clean water sources, a large scale solution will be difficult to implement [4]. Also a lack of education has made it difficult to implement irrigation

infrastructure. Villagers are generally not educated to the point that they fully understand the operation and maintenance of a drip irrigation system. Finally, a lack of resources has left the problem of sustainable irrigation unsolved in Burkina Faso. The people do not always have the money to purchase necessary supplies for these irrigation systems or the components needed to construct the systems are not readily available. This can make implementation and maintenance of an irrigation system impossible. Once something breaks, reverting to less effective irrigation can be the only option. Finally, the attitude of the Burkinabe natives may hinder our progress. Dr. Alaine Knipes of the CDC described the very conservative culture, which will complicate the introduction of non-traditional ideas. The attitude toward outsiders may also be problematic. Dr. Ruiz-Tiben of the Carter Center mentioned the necessity of bribes to enter or work on a chief's land. Even if we are working to support development of Burkina Faso, we will still be seen as outsiders. These factors all complicate a solution to Burkina Faso's sustainable irrigation issues, but our group hopes to aid in conquering these challenges.

The Solution:

Goal:

To address the problem of Burkina Faso's lack of sustainable irrigation, we are planning to implement a research project that tests three different irrigation systems. Our goal is to determine the most efficient irrigation system of the three so that Burkinabe farmers and NGOs will have a research study that determines the system that uses water the most efficiently. Our scope is focused solely on this efficiency study to help us aid larger and more capable organizations better assist the people of Burkina Faso in obtaining sustainable irrigation systems and increasing crop yields. We have chosen this route due to the amount of foreign aid and investment into Burkina Faso, which is greater than 11 million dollars a year from the United States alone [5]. Our rationale is that if we are able to properly perform this efficiency study and distribute our findings to NGOs and Burkinabe farmers, we will be able to help many people in Burkina Faso efficiently utilize water to increase crop yields. This would directly impact 90% of the Burkinabe people, as it is this percentage of the population that engage in some form of farming [4]. In addition this study would impact all of the Burkina people as it would help them further develop as a nation.

Solution Description:

Due to the extensive nature of the problem, a lack of sustainable irrigation in Burkina Faso, we have decided to focus on an important foundation for solving this problem. This foundation is answering what irrigation system is best for Burkina people to use. We are defining best as the most efficient system out of the Zai method, pitcher irrigation method, and drip irrigation. We will perform an experiment with each system, growing a statistically significant amount of plants in Burkina Faso.

The Zai method is the current irrigation method Burkinabe farmers utilize. The Zai method is system in which the farmer digs small pits, measuring approximately 60 centimeters in diameter, and plants crop seeds within them. After the seeds have been planted the pits are filled with water as needed to irrigate the crop [6]. This irrigation method is not practiced exclusively

in Burkina Faso, but throughout much of Sub-Saharan Africa. It is known for being easy to implement but being sometimes ineffective.

A less known irrigation method, the pitcher irrigation method, is an alternative to the current Zai method. Pitcher irrigation involved the use of a bulb shaped olla (ceramic) clay pot. The shape of the pot is essential in the effectiveness of the system, this is because the bulb shape allows for plants' roots to grow to the pot and take the amount of water they desire [7]. This pot shape also allows for four to six plants to grow around a single pot. This system is noted for being easy to implement and low maintenance as it requires only refilling daily and re-firing (in a kiln) every two years.

The third system is the drip-irrigation system. This is a common technology in modern farms around the world. A drip-irrigation system that is gravity fed requires the filling of a bucket apparatus with water, then gravity causes the water to be pushed through drip-tape which is a long hose with several emitters that drip water into soil [8]. Plants are planted around each emitter along the tape. Drip irrigation systems are very effective in distributing water to plants but have some draw backs since they are a more complex system, such as potential clogging.

Through the efficiency study of these three irrigation systems, we hope to determine the system that yields the greatest amount of millet (due to the crop's popularity in Burkina Faso) with the least amount of water being input to the system. This will be determined through careful measurement and recording of the amount of water placed into each system and the weighing of the usable component of the millet. After determining the most efficient of the systems we plan to compile our results and study and give our findings to NGOs and people of Burkina to aid them in finding a sustainable irrigation system.

Objectives and Status Update:

Objective 1: Establish a research design for all three irrigation methods

In order to establish a research design for all three irrigation methods we utilized CAD software to draw out our systems in a very technical method. These drawings depict the amount of space between each pitchers as well as the length of each drip line and the height required for drip buckets. We also included the distance between each Zai pit as well as the size. In addition we determined that we will grow millet with each system, and a minimum of 40 millet plants will need to be grown with each system for the experiment to be statistically valid. In addition we determined that we will be measuring the amount of water into each system (in milliliters) and comparing this number to the weight of the usable component of each plant (in ounces) for each system. The amount of water into each system will be measured simply, with a measuring apparatus marked with milliliters, this will be recorded daily (as each system will be filled daily). The pitcher method will be measured daily for remaining water in centimeters of water that remain in the pitcher (done by placing a dry ruler into the pitcher), using a mathematical formula we will determine the amount of water remaining in the pitcher. The pitcher will then be filled to an inch below the neck (this will be marked for the ease of the volunteer/data collector). Zai pits will be filled daily as villagers do, this will be done using the same measuring apparatus as the drip system. The usable component of the crops will be measured using a scale. All of this has been determined, and written up in a rough draft of our experimental design. We are placing final touches on this document as well as data collection sheets for volunteers in Burkina Faso.

Objective 2: Determine a location to perform testing in the United States – preform dry runs (this will be considered complete when data collection begins)

Location for the testing of our systems in the United States was determined mid-March. The location that was selected was Caroline Wesson's land. The drip irrigation system and pitcher irrigation system we both implemented and corn was planted around each. Data collection sheets were created and data recording began late March. Data collection will continue into the end of May. A detailed write up and picture documentation exists for the dry runs. This objective is complete.

Objective 3: Create a list of possible issues that could occur in Burkina

A detailed list of systematic and logistical issues that could occur in Burkina has been compiled by the group. This list consists of methods for implementing all three systems, how to fix the drip irrigation system, since leaks can occur, as well as planting and recording guidelines. In addition we have worked heavily on logistics. We have a detailed list of all of our needs and have begun contact with Justin Gelb, a Peace Corp volunteer that is assisting us in fulfilling many of our logistical needs.

Objective 4: Select a final partnership

In the adjustment of our project towards leaning away from partnering with an NGO we decided to partner with the Peace Corp. This being said, our partnership is much less of a partnership and we are more just reliant on the Peace Corp for logistical help. This objective is not currently complete, it is still in progress. We have been speaking with NGO Helen Keller International (HKI) about working with them on our experiment, even though we were less interested in focusing on paring with an NGO. We are going to continue to communicate with the Peace Corp and HKI about the logistics of our project in hopes that one or both of the groups can give us what we seek in a partnership.

Objective 5: Determine final location, station for working

Our last objective is to determine a final location for performing our test. This objective is still in progress much like objective four. We have been in contact with the Peace Corp, who is assisting us in finding a plot of land to preform our experiment on. We have yet to secure land, but are hopeful that with the help of the Peace Corp (Justin Gelb) or HKI that we will be able to secure land for testing very soon. We have determined that we would like our land to be near Ouagadougou in order to make ground travel logistics easier on each member of our team.

Not mentioned in our team's initial objectives were the following objectives that we have determined are necessary for our project to be completed:

Objective 6: Receive Vaccinations

Each member of our team traveling to Burkina Faso, Paul Anderson and Walter Eaves, has received proper vaccinations for traveling to Burkina Faso.

Objective 7: Travel Arrangements: Purchase plane tickets, lodging, and determine ground transportation

Each of these logistical elements are still being determined as we move forwards with the project. We have yet to purchase plane tickets or determine our specific lodging situation. We do believe that we will be lodged in a church mission. In addition we know that it is very important to have proper ground transportation (a driver), we are still working on establishing this contact as well. This objective remains incomplete as we have yet to obtain these things.

How has the project changed over time?

Our project has experienced many changes, the first and greatest change was when the group refocused the project to an efficiency study. We originally wanted our project to be a developmental project, in which we would install a drip irrigation system in a village in Burkina Faso. We hoped that we would be able to spend a summer in the village working with villagers, helping them to use the technology effectively. We moved away from this project as we discovered that this would take years to implement rather than two to three months. We determined that the efficiency research study was a much better way for us to help create sustainable irrigation methods in Burkina Faso. Another change in our project occurred when we decided to work with the Peace Corp rather than partnering with an NGO (which proved to be very difficult). In addition we have opted to shorten our time in Burkina Faso to three weeks rather than two months. All of these refocuses have helped us to narrow our project and work at solving the foundation of the lack of sustainable irrigation issue; what system is the most efficient for the people of Burkina Faso?

Future:

Future Implications and Next Steps:

The future of our project lies in implementation, which we plan to do in May 2014. Currently we have started a logistical partnership with the Peace Corp, volunteer Justin Gelb. Gelb hopes to assist us in finding a place to implement our study. We think that performing the experiment in Burkina Faso is the best way to receive valid results for our study purpose. If we are unable to complete the study in Burkina Faso, we will begin the process of engineering our own soil, and performing the experiments locally. This being said, after we finish the experiment we will formally write up our results. This information will then be distributed to NGOs and the people of Burkina. We hope that our results will be able to help the people of Burkina to begin utilizing the most efficient and sustainable irrigation system available to them, in hopes of helping them increase crop yields and in turn develop as a nation.

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