ANALYSIS OF THE INFLUENCE OF EDUCATION ON HOUSEHOLD FOOD SECURITY IN RURAL AFRICA

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BACKGROUND INFORMATION

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ICIPE

The International Centre of Insect Physiology and Ecology (ICIPE) (www.icipe.org) was founded in 1970 by Prof. Thomas R. Odhiambo (http://www.thp.org/prize/87/odhiambo.htm), an Africa Prize Laureate, and one of the world's leading scientists and a pioneer in establishing Africa's indigenous scientific capacity. ICIPE was established in Nairobi, Kenya due to the concern of the overuse of commercial pesticides in Africa and for providing sustainable solutions to the pressing need for increased food production and improved health in rural communities of developing nations. Presently, ICIPE's Director General is a Swiss entomologist, Dr. Hans R. Herren, the 1995 World Food Prize Laureate. Since its inception, ICIPE's mission has been to help alleviate poverty, counter many of the problems of food security, and improve the overall health status of people in the tropics while relying on the utilization of much of the available natural resources. Although this organization is based in the country of Kenya, it can now claim residence in eleven nations throughout the world. ICIPE has also been noted to actively work in partnership with over 100 organizations worldwide, including 27 African universities and several non-governmental organizations (NGOs). ICIPE strives through research and development to aid in procuring the "4-Hs:" plant health, human health, animal health, and environmental health. Through research, extension work, and much collaboration, ICIPE increases awareness of new agricultural technologies and more resource-efficient procedures, raising the capabilities of farmers in developing nations.

Mbita Point Field Station

Residing on the eastern shores of Lake Victoria, Mbita Point Field Station (MPFS), established in 1980, overlooks hundreds of farms in Kenya's most fiscally disadvantaged district with the hope of improving the quality of life and decreasing the tribulations. Suba District, home to MPFS, was formed in June 1995 and covers over 1130 square miles of land and water according to a Kenyan Ministry of Agriculture and Rural Development report published in 2000. The district is comprised of the mainland as well as two major islands (Rusinga and Mfangano) and fourteen minor islands. It also boasts a population of 155,629 people according to the latest provincial census taken in 1999. The field station, itself, lies on slightly more than 60 acres of land, but it serves people of the more than 140 million acre nation and beyond. Current sectors of research include malaria, crop and horticultural pests, and tick and tsetse fly prevention and control. MPFS is also actively involved in the promotion of the cultivation of commercial insects and supports pursuits such as apiculture and sericulture. Both of these activities have proven to be important income- and employment- generating industries. Through the constant study of insects and their effect on humans, plants, animals and the environment, the scientists at MPFS work to create new procedures and technologies and to provide essential ecological services to the people of Suba District. The diffusion of new knowledge has proven to be a vital and successful component of the

work done at the Mbita Point Field Station. Empowering the individual, therefore, continues to be one of the highest priorities at the field station as numerous scholars, university students, and various scientists work together to utilize their resources and unveil new and valuable discoveries.

The Habitat Management Program

With the number of hungry mouths in Kenya steadily growing, the size of the available, arable land used for the cultivation of the major food crops (such as maize and sorghum) is increasingly being depended on. However, the presence of stemborers and parasitic weeds amidst the crops, along with various other constraints, has had severe negative effects on this vital food production. In an effort to address many of these hindrances, Dr. Zeyaur Khan, an entomologist at MPFS, has led a group of researchers, funded by the Gatsby Charitable Foundation of the United Kingdom, the Rockefeller Foundation of the United States, and the Global Environmental Facility of the United States, to focus on the use of biologically based methods to improve crop yields in the region. Through this collaborative effort, the Habitat Management Program is attempting to find and incorporate new technologies to deal with the problem of low crop productivity in Suba District. This problem is believed to be associated with many major constraints, including unreliable weather (extreme droughts and erratic rainfall), soil erosion, and pest and parasitic weed infestations.

One of the main staple crops in eastern Africa is maize. This definitely holds true for Kenya, an African nation known for its growth of cereal crops. In general, the maize is grown on a small-scale for consumption and tends to have very low yields. The yields are so minimal that Africa's annual maize production is estimated at being less than half of the annual production in Asia and Latin America. Unfortunately, in Suba, as in much of Africa, maize growth has been seriously disrupted by the infiltration of stemborers. Stemborers are the moths that burrow into the stalk of cereal crops during their larval stage. They feed on the young, maturing crops, frequently stunting growth and sometimes even destroying the yield. The prevalent species of cereal stemborers wreaking havoc in Suba include the noctuids *Busseola fusca* and various *Sesamia* species, particularly *S. calamistis* and *S. cretica.* The *Chilo partellus* is another disastrous stemborer species that was accidentally introduced from Asia to eastern and southern Africa earlier this century. Suba has a major dilemma with these stemborers that are known to create yield losses of 20-40%.

Stemborers are far from being the only major constraint to crop production in Suba. Witch weed, *Striga hermonthiea*, is the most notorious for causing severe damage to cereal production. This parasitic weed will often attack as the maize is still only a few weeks old. They grow surrounding the maize and, if they attack early enough, they can destroy the crop all together. These weeds are in fact noted as creating yield losses between 30-100%, which is approximately equivalent to a loss of 7-13 billion dollars! To increase the devastation, they also suck most of the nutrients out of the soil, making it unsuitable for successful plantings in following years.

Current materials and equipment to prevent these horrendous crop losses, such as the use of commercial pesticides and herbicides, are usually unavailable or too expensive for the small-scale, impoverished, subsistence farmers that are dominant in both Suba and Africa. Unfortunately, traditional methods frequently utilized by these farmers are in fact deemed extremely ineffective. Therefore, the need for other solutions to these controversies was apparent. Thus, the Gatsby Project came out with a novel solution to control stemborers and the striga weed, the 'push-pull' strategy.

The 'push-pull' strategy for the prevention of stemborers and striga is very appropriately named. This naturally-based control technique utilizes various indigenous grasses to repel and trap stemborers while revitalizing the soil. The grasses are planted in a border around the maize fields. They then secrete a chemical that the moths (adult stemborers) are attracted to. The grass then discharges another sticky substance that traps and kills the moth with an approximately 80% success rate. In this manner, the surrounding grasses "pull" the adult stemborers away from the crops and prevent them from laying the eggs for the next disastrous generation. The grasses most commonly used as the "pull" plant are Napier Grass (*Pennisetum purpureum)* and Sudan Grass (*Sorghum Vulgare sudanese),* the latter being a type of wild sorghum. The second half of this control method involves intercropping the cereal crop with yet another plant known for emitting chemicals those act as stemborer repellents. The plants found to be the most successful in "pushing" away the stemborers thus far are the various species of the *Desmodium,* a leguminous plant. This is where the "push" portion of the technique's title is derived.

In addition to eradicating the stemborers, the 'push-pull' strategy has several other benefits. The intercropping of Desmodium works to fight the striga until the parasitic weed disappears, for the most part, from the field. It also replenishes many of the soil's nutrients (such as nitrogen, which is a main component of fertilizer) that are used up by the maize crop every year. Also, the soil remains moist for longer durations of time. The pull plants surrounding the field protect the crops against strong winds, shielding them from blowing over. The Napier also helps to hold the soil together and fights soil erosion. Both plants utilized in this strategy are a good source of fodder for livestock and can even be sold as such by the farmers. Most importantly, though, this method results in healthier plants and higher yields without the use of harmful chemicals. This technique is extremely cost- and resource-efficient and is a practical method for the prevention and control of stemborers and striga.

The Gatsby Project continues to further its own knowledge by conducting even more research about the push-pull technology. Currently, the most important step being taken to ensure the success of farmers in Suba is disseminating the information on the new agricultural technologies, such as push-pull. This technology is rapidly spreading and has already reached several nations besides Kenya including Tanzania, Ethiopia, and other parts of Eastern Africa. Working in cooperation with the national Ministry of Agriculture, numerous NGOs, and the farmers themselves, the Gatsby project has aided in making increased food security a more attainable goal.

INTRODUCTION

INTRODUCTION

Analysis of the Influence of Education on Household Food Security in Rural Africa

Give a hungry man fish and he will be hungry again the next day. Teach a hungry man to fish and he will have the ability to eat again the next day. This well-known saying explodes with a truth that is finally being realized universally. In Kenya, the largest portion of the family income isn't spent on food, clothing, or basic living necessities. In most households in Suba, over half of the income is in fact spent on school fees. The nation is finally realizing that education is extremely important. Even with these large portions of money being spent on schooling in hopes of increasing the quality of life, the farmers of Suba still find themselves troubled over the issue of household food security.

The magnificent continent of Africa is the only place in the world where the problem of food security is not only prevalent, but growing rampantly despite the numerous research efforts being made. Through this study, I have been able to directly interact with a large variety of local farmers, listen to their perspectives on their situation, and even to their solutions and recommendations of what needs to be addressed. From the start I realized that a lack of quality schooling was a constraint in this nation. I have hypothesized that many of the citizens' problems, including the high rates of diseases and the extreme fiscal controversies, come back to this basic hindrance. By analyzing the livelihoods of these people, I believe that I am able to make specific suggestions as to what actions need to be taken to improve their quality of life.

In order to see what type of knowledge is vital in the region and still needs to be disseminated on a more widespread basis, a questionnaire was developed to survey farmers in Suba while on attachment under the Gatsby Project. The study that I have performed analyzed the health, agronomic, and socioeconomic aspects of farmers in Suba District, Kenya with reference to their educational backgrounds.

Objectives

1. ***To identify the current problems faced by farmers, their solutions, and their knowledge on the causes of these problems.***
2. ***To identify the farmer's awareness of new agricultural techniques, the effects of these techniques, the rate of implementation, and the resource- and production-efficiencies with consideration of the farmer's educational status.***
3. ***To identify the economic status of farmers with reference to the influence of education.***
4. ***To identify the levels of education and the aspirations of members of the farmer's household and the degree of gender sensitization.***
5. ***To identify the regional health problems, the farmer's awareness of such problems and their prevention or solution, and the rate of occurrences of these problems with reference to educational statuses.***
6. ***To identify the regional causes of poverty, the farmer's perspectives on the issue of poverty, possible resolutions to this dilemma, and a potential approach on how education can be utilized to improve household food security.***

PROCEDURES AND METHODOLOGY

PROCEDURES AND METHODOLOGY

I began my research out in the field. My first mission was to develop a better understanding of the culture, the lifestyles, and most importantly, the people. After my first few visits to various villages and farms, a questionnaire was created with the aid of Dr. Khan, Principal Scientist and Leader of the Grass Ecosystems Program at ICIPE, and Mrs. Matilda Auma Ouma, Ecological Trainer in the ICIPE-Biovision Technology Transfer Unit. This questionnaire (Appendix 1, Pages 1-6) consisted of questions related to several aspects of the lives of farmers in Suba District including the health, agronomic, and socioeconomic factors in relation to education.

This questionnaire was then utilized to interview a large variety of farmers at their homesteads. In this effort, all perspectives were to be represented and analyzed equally. Therefore, 15 of the interviews were conducted with farmers who are currently participating in ICIPE's new agricultural technology programs (the Gatsby Project), while the remaining 15 of the interviews were comprised of non-participating farmers.

In order to balance the differences in opinion based on gender, an attempt was made to have an equal distribution of female and male interviewees. Of the 15 project farmers, 10 were male project farmer (MPF) and 5 were female project farmer (FPF). Of the 15 non-project farmers, 8 were male non-project farmer (MNPF) and 7 were female non-project farmer (FNPF). After conducting the interviews and visiting with the local community members, the data was gathered, analyzed, and compiled into the several charts that follow.

RESULTS

RESULTS

Part 1: Basic Characteristics of Respondents

1.1.1 Years of Project Participation/ Plans for Adoption of Technology

Table 1: Project Participation Status

Years of Participation	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
< 1	1	10	0	0	n/a	n/a	n/a	n/a
1 – 3	3	30	1	20	n/a	n/a	n/a	n/a
> 3	6	60	4	80	n/a	n/a	n/a	n/a
Wants to Adopt	n/a	n/a	n/a	n/a	8	100	7	100

The majority of project farmers, both male and female, have been practicing the 'push-pull' technology for more than 3 years, but this longer length of time is more prevalent with the women project farmers. All of non-project farmers, both male and female, have interests in adopting this agricultural technology.

1.1.2 Age of Respondents

Table 2: Age of Respondents

Age (in years)	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
< 25	0	0	0	0	0	0	1	14.3
25-35	2	20	1	20	3	37.5	3	42.9
36-45	3	30	0	0	2	25	2	28.6
46-55	2	20	3	60	2	25	1	14.3
> 55	3	30	1	20	1	12.5	0	0

The ages of the 30 interviewees were mainly scattered in the range of 25 years and above. 60% of the male project farmers were either between the ages of 36-45 years or were older than 55. 60% of the female project farmers were in the age bracket of 46-55 years. 37.5% of the male non-project farmers were between the ages of 25-35 years, while nearly 43% of the female non-project farmers were between the ages of 25-35 years.

1.1.3 Number of Household Inhabitants

Table 3: Number of Household Inhabitants

# of People in Household	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
1-4	1	10	0	0	0	0	1	14.3
5-8	2	20	1	20	5	62.5	4	57.1
9-12	3	30	4	80	2	25	2	28.6
13-15	2	20	0	0	1	12.5	0	0
> 15	2	20	0	0	0	0	0	0

The male project farmer households varied the most in size, but 30% reported that there were between 9-12 inhabitants. The majority of female project farmers (80%) also belonged to households where there were between 9-12 occupants. The majority of both male and female non-project farmers interviewed (62.5% and 57.1%, respectively) claimed that there were between 5-8 inhabitants of their households. Overall, it was apparent that the interviewed project farmers, regardless of gender, seemed to have larger households than the interviewed non-project farmers.

1.1.4 Land Ownership

Table 4: Area of Land Owned

Area of Land (in acres)	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
1-5	3	30	1	20	2	25	2	28.6
>5-10	2	20	1	20	4	50	2	28.6
>10-15	1	10	2	40	0	0	2	28.6
>15-20	0	0	0	0	1	12.5	0	0
>20-25	4	40	1	20	1	12.5	0	0
N/A	0	0	0	0	0	0	1	14.3

The project farmers, regardless of gender, were more likely to own a larger area of land in comparison to the non-project farmers. 40% of the male project farmers reported land holdings of greater than 20 - 25 acres. 40% of the female project farmers claimed holdings of greater than 10 - 15 acres. 50 % of the male project farmers owned greater than 5 - 10 acres, while almost all of the female project farmers owned 1 - 15 acres of land.

1.1.5 Types of Crops Grown

Table 5: Subsistence Crops Grown

Type of Crop	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Maize	10	100	5	100	8	100	7	100
Sorghum	6	60	4	80	8	100	5	71.4
Millet	3	30	1	20	1	12.5	2	28.6
Beans	7	70	4	80	6	75	6	85.7
Peanuts	5	50	30	60	3	37.5	3	42.9
Tapioca/Cassava	2	20	2	40	0	0	0	0

All the farmers interviewed, regardless of project participation status, did grow maize as a consumption crop. The majority of farmers involved with this study also grew sorghum (60% of the male project farmers, 80% of the female project farmers, 100% of the male non-project farmers, and 71.4% of the female non-project farmers). Beans were an additional crop that was frequently grown (70% of male project farmers, 80% of female project farmers, 75% of male non-project farmers, and 85.7% of female non-project farmers). Finally, peanuts were found to be yet another popular subsistence crop grown by both project and non-project farmers (50% of male project farmers, 60% of female project farmers, 37.5% of male non-project farmers, and 42.9% of female non-project farmers).

Table 6: Cash Crops Grown

Cash Crops	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Cotton	7	70	3	60	6	75	2	28.6
Sisal	4	40	2	20	1	12.5	2	28.6
Sunflower	3	30	0	0	0	0	1	14.3
Peanuts	2	20	1	20	0	0	0	0
Beans	1	10	1	20	0	0	0	0
None	0	0	0	0	1	12.5	3	42.9

Regardless of gender, project farmers seemed to grow a larger variety of cash crops, and all project farmers grew at least one type, if not more. Almost half (42.9%) of the female non-project farmers, however, didn't take part in growing cash crops. The most popularly grown cash crop was cotton with 70% of the male project farmers, 60% of the female project farmers, 75% of male non-project farmers, and 28.6% of the female non-project farmers all taking part in its cultivation. Sisal was also a commonly grown cash crop. Within each respective participation classification (project versus non-project), the male farmers were more involved in growing a variety of cash crops.

1.1.6 Livestock Ownership

Table 7: Livestock Owned

Type of Livestock	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Cattle	9	90	5	100	8	100	4	57.1
Goats	3	30	2	40	5	62.5	3	42.9
Sheep	4	40	2	40	3	37.5	2	28.6
Poultry	4	40	3	60	8	100	6	85.7
Donkey	2	20	1	20	1	12.5	1	14.3
None	0	0	0	0	0	0	1	14.3

Out of all of the interviewed farmers, only 1, a female non-project farmer, did not own any livestock. The majority of farmers interviewed owned some type, either local or grade, of cattle (90% of the male project farmers, 100% of the female project farmers, 100% of the male non-project farmers, and 57.1 % of the female non-project farmers). Goats were also popular, especially with the non-project farmers, while the project farmers tended to prefer sheep. A large majority of farmers also owned poultry (40% of male project farmers, 60% of female project farmers, 100% of male on-project farmers, and 85.7% of female non-project farmers), but such ownership was especially dominant in non-project farmer households.

Table 8: Local Cattle Ownership

# of Local Cattle Owned	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
0	1	10	2	40	0	0	3	42.9
1-5	5	50	2	40	4	50	3	42.9
6-10	2	20	0	0	4	50	0	0
11-15	1	10	1	20	0	0	1	14.3
> 15	1	10	0	0	0	0	0	0

Table 9: Grade Cattle Ownership

# of Grade Cattle Owned	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
0	6	60	1	20	7	87.5	6	85.7
1-5	4	40	4	80	1	12.5	1	14.3

When it came to local cattle, 50% of the male project farmers owned 1-5, 40% of the female project farmers owned 1-5, and another 40% of the female project farmers

owned none at all. 100% of the male non-project farmers owned at least some local cattle, 50% of them owning 1-5 and the remaining 50% owning between 6-10. 42.9% of the female non-project farmers didn't own any local cattle, while another 42.9% of them owned between 1-5 local cattle. The ownership of grade cattle was far more prevalent in project farmer households, regardless of gender, than in non-project farmer households. 40 % of the male project farmers and 80% of the female project farmers owned grade cattle, whereas a mere 12.5% of the male non-project farmers and 14.3% of the female non-project farmers owned grade cattle.

Part 2: Research Findings

Objective 1: Farmer's Problems, Knowledge, and Solutions

2.1.1 Utilization of Land

Table 1: Area of Land Uncultivated

Area Unused (in acres)	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
0 - <1	4	40	0	0	1	12.5	2	28.6
1 – 3	2	20	3	60	4	50	1	14.3
> 3 – 6	1	10	0	0	1	12.5	2	28.6
> 6 – 9	0	0	1	20	0	0	1	14.3
> 9	3	30	1	20	2	25	0	0
N/A	0	0	0	0	0	0	1	14.3

Table 2: Reason for Uncultivated Land

Reason for Not Cultivating	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Pastureland/ Homestead	4	40	2	40	4	50	3	42.9
Lack of Labor	2	20	0	0	1	12.5	0	0
Lack of Finances	1	10	0	0	1	12.5	0	0
Lack of Equip.	3	30	3	60	2	25	2	28.6
Other	1	10	0	0	0	0	1	14.3
N/A	2	20	0	0	1	12.5	2	28.6

40 % of male project farmers owned less than one acre of land that was uncultivated. This land, in most cases was instead utilized as pastureland or for the homestead. The majority (60%) of female project farmers owned between 1 and 3 acres of uncultivated land. In 40% of the female project farmer's homes, the excess land was used as pastureland or for the homestead, but the majority claimed that they had left their land uncultivated due to a lack of farm equipment, especially animal draft power. 50% of the male non-project farmers had left 1-3 acres of their land uncultivated and in the majority of cases, they claimed to have used the land as pastureland or for the homestead. Nearly 30% of the female non-project farmers had left less than 1 acre of land uncultivated and an additional 30% of them had left between 3 and 6 acres uncultivated. 42.9% of these female non-project farmers left land open in order for it to be used as pastureland or for the homestead. The biggest constraint for cultivating land for all farmers, regardless of project participation status and gender, was the lack of farm

equipment, particularly animal draft power.

Table 3: Level of Education vs. Area of Land Cultivated

Years of Education *Area Uncultivated (in acres)*	None out of 1 Ratio	%	1 - 8 out of 13 Ratio	%	9 - 12 out of 15 Ratio	%	College and Beyond out of 1 Ratio	%
0 - < 1	0	0	6	46.2	2	13.3	0	0
1 – 3	0	0	4	30.8	6	40	0	0
> 3 – 6	0	0	1	7.69	1	6.67	1	100
> 6 – 9	0	0	0	0	2	13.3	0	0
> 9	1	100%	2	15.4	3	20	0	0
N/A	0	0	0	0	1	6.67	0	0

The general trend observed was that the farmers with more years of education seemed to leave less of their land uncultivated. The overall resource-efficiency appeared to decrease as the number of years of education decreased.

2.1.2 Crop Constraints

Table 4: General Constraints in Crop Production

Crop Constraints	MPF out of 10 *Ratio*	*%*	FPF out of 5 *Ratio*	*%*	MNPF out of 8 *Ratio*	*%*	FNPF out of 7 *Ratio*	*%*
Weed Infestations	9	90	5	100	8	100	6	85.7
Pest Infestations	10	100	4	80	8	100	6	85.7
Weather	9	90	4	80	6	75	6	85.7
Lack of Resources(info, equip., $, etc.)	5	50	5	100	6	75	4	57.2
Wildlife	3	30	2	40	3	37.5	0	0
Other (market, infrastructure, etc.)	5	50	2	40	1	12.5	2	28.6

Table 5: Constraints in Maize Farming

Constraints	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Striga	9	90	5	100	8	100	6	85.7
Stemborer	9	90	5	100	8	100	6	85.7
Storage Weevil	3	30	0	0	1	12.5	1	14.3

The two biggest problems in general crop production faced by almost all farmers interviewed were weed and pest infestations. Specifically in maize farming, the striga and stemborer problems were prevalent. Only two of the thirty farmers interviewed didn't complain of striga or stemborers invading their maize fields. Weather and a lack of resources were two more dilemmas that the majority of farmers complained of facing in general crop production. In maize farming, a newly realized tribulation, the storage weevil, was frequently reported by farmers, especially male project farmers. 30% of the male project farmers interviewed listed the weevil as major constraint to maize production.

Table 6: Farmer's Solutions to Striga and Stemborers

Attempted Solutions	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Intercropping Legumes	0	0	0	0	3	37.5	2	28.6
Crop Rotation	7	70	1	20	7	87.5	4	57.2
Weeding/Uprooting	3	30	3	60	4	50	5	71.5
Early Maturing Crops	0	0	2	40	1	12.5	1	14.3
Cow Dung	8	80	3	60	6	75	5	71.5
Push-Pull	10	100	5	100	0	0	0	0
Other	0	0	1	20	0	0	0	0

The farmers not utilizing the push-pull technology still attempted to use the method of intercropping various legumes in between the crops. 37.5% of the male non-project farmers and 28.6% of the female non-project farmers utilized the intercropping procedure. The use of cow dung to control for striga was popular with all groups of farmers. 80% of the male project farmers, 60% of the female project farmers, 75% of the male non-project farmers, and 71.5% of the female non-project farmers all utilized cow dung in their fields. Overall, the non-project farmers seemed to do more manual labor in their fields, such as hand weeding and uprooting.

2.1.3 Farmer's Knowledge of Major Constraints

Table 7: Stage of Maize Growth when Stemborers Attack

Stage of Growth	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Knee-high	2	20	2	40	0	0	3	42.9
At Tasseling	7	70	1	20	8	100	3	42.9
At Cobbing	1	10	1	20	0	0	1	14.3
At Germination	0	0	1	20	0	0	0	0

The peak of the attack by the stemborers usually takes place when the maize is between knee-high and tasseling. The majority of male farmers, 90% of the male project farmers and 100% of the male non-project farmers, were aware of this information. The female farmers were also equipped with the accurate information. 60% of the female project farmers and 86% of the female non-project farmers knew the correct stages of growth in which the maize was attacked.

Table 8: Stage of Maize Growth when Striga Attacks

Stage of Growth	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Knee-high	7	70	3	60	4	50	6	85.7
At Tasseling	0	0	1	20	4	50	0	0
At Cobbing	0	0	0	0	0	0	1	14.3
At Germination	3	30	1	20	0	0	0	0

In the fields symptoms of a striga attack on the cereal crops are observed when they are approximately knee-high to the stage of tasseling. The majority of farmers interviewed were aware of this. 70% of the male project farmers, 80% of the female project farmers, 100% of the male non-project farmers, and 85.7% of the female non-project farmers all had accurate knowledge in this regard. However, only 30% of the male project farmers and 20% of the female project farmers knew that the striga attack on cereal crops could starts at germination of the plants.

Table 9: Knowledge of Stemborer Lifecycle

Quantity of Knowledge	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
None	3	30	2	40	5	52.5	7	100
Partial	4	40	2	40	3	37.5	0	0
Complete	3	30	1	20	0	0	0	0

70% of the male project farmers and 60% of the female project farmers were

aware of at least part, if not all, of the lifecycle of the stemborer. Only 37.5% of the male non-project farmers were aware of even part of the lifecycle and none of them knew it completely. 100% of the female non-project farmers were entirely unaware of the stemborer's lifecycle. Overall, the project farmers were much more informed than the non-project farmers.

2.1.4 Livestock Constraints

Table 10: General Livestock Constraints

Constraints	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Tsetse	10	100	5	100	7	87.5	5	71.5
Ticks	10	100	4	80	8	100	5	71.5
Diseases	5	50	4	80	5	52.5	6	85.7
Drought	4	40	2	40	3	37.5	2	28.6
Shortage of Drugs	1	10	1	20	0	0	2	28.6
Other	2	20	3	60	3	37.5	2	28.6
N/A	0	0	0	0	0	0	1	14.3

100% of the project farmers, 87.5% of the male non-project farmers, and 71.5% of the female non-project farmers had the problem of tsetse infecting their livestock with diseases. 100% of the male farmers, 80% of the female project farmers, and 71.5% of the female non-project farmers reported that ticks severely disrupted their livestock production. Livestock diseases was another major constraint that 50% of the male project farmers, 80% of the female project farmers, 82.5% of the male non-project farmers, and 85.7% of the female non-project farmers suffered from.

Table 11: Farmer's Solutions to Ticks

Attempted Solutions	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Acaricide	10	100	4	80	8	100	5	71.5
Manual Removal	1	10	0	0	0	0	0	0
N/A	0	0	1	20	0	0	2	28.6

All farmers interviewed who did have a problem with ticks had used acaricide to eradicate the pests. Only one farmer, a male project farmer, manually removed the ticks in addition to spraying his livestock with insecticides.

Table 12: Farmer's Solutions to Tsetse

Attempted Solutions	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Insecticides	2	20	2	40	2	28.6	0	0
Trap	4	40	4	80	2	25	0	0
Other	2	20	0	0	1	12.5	0	0
Nothing	3	30	0	0	3	37.5	5	71.5
N/A	0	0	0	0	1	12.5	2	28.6

All of the female project farmers took some preventive action against tsetse. 80% of them used the tsetse Ngu-trap, which was developed by ICIPE in the 1980s. 40% of the male project farmers also utilized this technology. Non-project farmers, though, were most likely to not take any preventive measures. 37.5% of the male non-project farmers and 71.5% of the female non-project farmers did nothing to control the tsetse attacking their livestock.

2.1.5 Farmer's Utilization of the Ngu-trap to Prevent Tsetse

Table 13: Farmer's Rate of Usage

Use of Trap	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Yes	4	40	4	80	2	25	1	14.3
No	6	60	1	20	6	75	6	85.7

Project farmers were much more likely to use the Ngu-trap as a preventive measure against tsetse. 40% of male project farmers and 80% of female project farmers utilize this technology, while only 25% of the male non-project farmers and 14.3% of the female project farmers did.

Table 14: Farmer's Suffering from Livestock Diseases (Trypanosomiasis) Transmitted by Tsetse vs. Trap Usage

Usage and Disease Status	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Uses and has diseases	1	10	3	60	1	12.5	1	14.3
Doesn't use & has diseases	4	40	0	0	4	50	5	71.5
Uses and no diseases	3	30	1	20	1	12.5	0	0
Doesn't use & no diseases	2	20	1	20	2	25	0	0
N/A	0	0	0	0	0	0	1	14.3

The majority of non-project farmers did not use the Ngu-trap, but they did demonstrate a need for the trap since much of their livestock was being infected with disease (trypanosomiasis) by the tsetse fly. This included 50% of the male non-project farmers, 71.5% of the female non-project farmers, and even 40% of the male project farmers. All farmers using the trap did comment on its effectiveness, but 60% of the female project-farmers utilizing the technology still had livestock being infected with diseases. Still, 30% of the male project farmers and 20% of the female project farmers used the trap and did not complain of their livestock being infected.

Table 15: Farmer's Reasons for Not Using Ngu-Trap

Reason for not Using	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Lack of Accurate Info.	2	20	0	0	3	37.5	4	57.2
Unneeded or too Expensive	1	10	0	0	1	12.5	0	0
Unavailability	2	20	1	20	1	12.5	0	0
N/A	5	50	4	80	3	37.5	3	42.9

The majority of non-project farmers suffered from a lack of accurate information and were therefore unable to take advantage of this preventive technology. This accounts for 57.2% of the female non-project farmers and 37.5% of the male non-project farmers. 20% of male project farmers and 20% of female project farmers claimed that they were unable to attain the traps although they wished to do so.

Table 16: Level of Education vs. Ngu-Trap Usage

Trap Usage Years of Education	*Uses Trap* *%*	*Ratio*	*Doesn't Use Trap* *%*	*Ratio*
None out of 1	0	0	1	100
1-4 out of 1	0	0	1	100
5-8 out of 12	3	25	9	75
9-12 out of 15	8	53.3	7	46.7
College & beyond out of 1	0	0	1	100

The likelihood of using the Ngu-trap for tsetse prevention raised as the number of years of education of the farmers increased. After reaching high school, however, further education made no difference in this matter. In fact, none of the farmers interviewed that had been educated through college used the trap

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Objective 2: Farmer's Push-Pull Awareness

2.2.1 Education Level of Respondents

Table 1: Education level of Respondents vs. Participation Status

Years of Education	MPF out of 10 *Ratio*	*%*	FPF out of 5 *Ratio*	*%*	MNPF out of 8 *Ratio*	*%*	FNPF out of 7 *Ratio*	*%*
0	0	0	0	0	1	12.5	0	0
1-8	3	30	1	20	6	75	3	42.9
9-12	7	70	4	80	0	0	4	57.1
> 12	0	0	0	0	1	12.5	0	0

There was only one farmer, a male non-project farmer, who had not received any formal education. The majority of project farmers, 70% of the males and 80% of the females, and 51.7% of the female non-project farmers had gone on to secondary school and had received between nine and twelve years of education. However, female project farmers were the most likely to have received some secondary education. 75% of the male non-project farmers had only received primary education. Only one farmer, male non-project, had received any education beyond that of high school. Overall, farmers who had received at least some secondary education were more likely to become project farmers.

Table 2: Level of Education vs. Duration of Project Participation

Years of Part. Years of Education	*<1 Ratio*	*%*	*1-3 Ratio*	*%*	*>3 Ratio*	*%*	*N/A Ratio*	*%*
None out of 1	0	0	0	0	0	0	1	100
1-4 out of 1	0	0	0	0	0	0	1	100
5-8 out of 12	0	0	2	16.7	2	16.7	8	66.7
9-12 out of 15	1	6.67	2	13.3	8	66.7	4	26.7
College & beyond out of 1	0	0	0	0	0	0	1	100

As the number of years of education of the farmer increased, the more likely it became that the farmer had utilized the 'push-pull' technology for a longer duration of time. 66.7% of the project farmers that had completed at least a portion of secondary school had used this technology almost since its availability.

2.2.2 Farmer's Benefits

Table 3: Farmer's Benefits from Push-Pull technology

Benefits	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Higher Yields	9	90	3	60	n/a	n/a	n/a	n/a
Reduced Striga	2	20	3	60	n/a	n/a	n/a	n/a
Reduced Stemborers	3	30	3	60	n/a	n/a	n/a	n/a
Fodder for Livestock	8	80	2	40	n/a	n/a	n/a	n/a
Commercial use of Fodder and Seeds	3	30	1	20	n/a	n/a	n/a	n/a
Increased Soil Fertility	5	50	1	20	n/a	n/a	n/a	n/a
Other	4	40	2	40	n/a	n/a	n/a	n/a

The majority of the project farmers stated that the biggest benefit of the push-pull technology is that it increased their crop yields. 90% of the male project farmers and 60% of the female project farmers agreed to this. The ability to use Napier and Desmodium as fodder for livestock was yet another major advantage of the technology. 80% of the male project farmers and 40% of the female project farmers utilized the grasses in this manner. Other major advantages resulting from the use of the push-pull technology included the reduction of stemborers, striga, and increased soil fertility.

2.2.3 Sources of Information on Agricultural Technology

Table 4: Farmer's Sources of Information on the Push-Pull Strategy (PPS)

Sources of Information	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Neighbors	2	20	1	20	4	50	3	42.9
Extension Staff	2	20	1	20	0	0	1	14.3
ICIPE/Biovision	9	90	4	80	5	62.5	5	71.4
Field Days	1	10	0	0	2	25	2	28.6
Baraza	1	10	1	20	0	0	0	0
Unaware of PPS	0	0	0	0	1	12.5	1	14.3
Other	1	10	0	0	0	0	0	0

For all classifications of farmers, the most common source of information on the push-pull strategy was ICIPE, often in conjunction with [1]Biovision. 90% of the male project farmers, 80% of the female project farmers, 62.5% of the male non-project farmers, and 71.4% of the female non-project farmers all received information on the technology from ICIPE and Biovision. For project farmers, this was almost the sole source of information. Non-project farmers, however, also heavily relied on receiving information from their neighbors, which was the case for 50% of the males and 42.9% of the females. 25% of the male non-project farmers and 28.6% of the female non-project farmers also received their information about push-pull during field days.

Table 5: Level of Education vs. Sources of Information

Years of Education *Sources of Info.*	None out of 1		1-8 out of 13		9-12 out of 15		College + out of 1	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Neighbors	1	100	3	23.1	5	33.3	1	100
Extension Staff	0	0	2	15.4	2	13.3	0	0
ICIPE/Biovision	0	0	9	69.2	13	86.7	1	100
Field Days	0	0	1	7.69	3	20	1	100
Baraza	0	0	2	15.4	0	0	0	0
Unaware of PPS	0	0	1	7.69	1	6.67	0	0
Other	0	0	0	0	1	6.67	0	0

As the level of education of the farmer increased, the probability of having received information about push-pull directly from ICIPE and [1]Biovision also increased. None of the farmers devoid of formal education, 69.2% of the farmers with 1-8 years, 86.7% of the farmers with 9-12 years, and 100% of the farmers with a college education or beyond had received information from ICIPE or Biovision. There was also a direct correlation between the number of years of education and the probability of receiving

information via field days. 0% of the farmers with no formal education, 7.69% of the farmers with 1-8 years, 6.67% of the farmers with 9-12 years, and 100% of the farmers with a college education or beyond had received information by attending field days.

Objective 3: Farmer's Financial Acumen

2.3.1 Household Income Level

Table 1: Farmer's Annual Household Income

Income Levels (in 1000s Ksh.)	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
<60	3	30	0	0	5	62.5	5	71.4
60 – 150	7	70	5	100	3	37.5	0	0
>150	0	0	0	0	0	0	2	28.6

The current exchange rate stands at approximately 75 Kenyan Shillings for every US dollar. There were only two farmers, both female non-project farmers, whose annual household income exceeded 150,000 Ksh. The majority of non-project farmers, 62.5% of the males and 71.4% of the females, belonged to households where the total annual income fell below 60,000 Ksh. However, 70% of the male project farmers and 100% of the female project farmers belonged to households where the annual income fell between 60,000 Ksh. and 150,000 Ksh. Overall, the project farmers tended to have higher household incomes.

Table 2: Level of Education vs. Farmer's Annual Household Income

Income Levels (in Ksh.) Years of Education	*<60,000*	*Ratio*	*60,000-150,000*	*Ratio*	*>150,000*	*Ratio*
	%		*%*		*%*	
None out of 1	1	100	0	0	0	0
1-4 out of 1	1	100	0	0	0	0
5-8 out of 12	6	50	6	50	0	0
9-12 out of 15	5	33.3	7	46.7	3	20
College & beyond out of 1	0	0	1	100	0	0

A direct relationship between the number of years of formal education and the annual household income was descried. All of the farmers with four years of education or less belonged to households where the annual income fell below 60,000 Ksh. 50% of the farmers with higher levels of primary education lived in households that made between 60,000 and 150,000 Ksh. annually. The majority of the farmers who had received at least some secondary education belonged to households that earned at least 60,000 Ksh. per year. 20% of them even belonged to households earning more than 150,000 Ksh. per year. 100% of the farmers having received at least a college degree

resided in households where the annual income was equal to or surpassed 60,000 Ksh.

2.3.2 Sources of Income

Table 3: Number of Sources of Income

Number of Sources	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
1	4	40	3	60	3	37.5	2	28.6
2	5	50	2	40	2	25	5	71.4
3	1	10	0	0	3	37.5	0	0

Only males were likely to have three sources of income. 50% of the project males and 71.4% of the non-project females belonged to households where there were two sources of income. The majority of female project farmers, 60%, lived in households where there was only one source of income. 37.5% of the male non-project farmers belonged to households where there was only one source of income and another 37.5% of them lived in households where there were three sources of income.

Table 4: Level of Education vs. Number of Sources of Income

Number of Sources Years of Education	*1 Ratio*	*%*	*2 Ratio*	*%*	*3 Ratio*	*%*
None out of 1	0	0	0	0	1	100
1-4 out of 1	0	0	1	100	0	0
5-8 out of 12	6	50	3	25	3	25
9-12 out of 15	6	40	9	60	0	0
College & beyond out of 1	0	0	1	100	0	0

Farmers who hadn't received any formal education were the most likely to belong to households with three sources of income. This was true with all farmers interviewed that hadn't received any formal education. 100% of the farmers with 1-4 years of education, 60% of the farmers with some secondary education, and 100% of the farmers with a college degree or beyond belonged to households where there were two steady sources of income. Farmers having received between 5-8 years of education were more likely to reside in households having only one steady source of income.

Table 5: Farmer's Annual Household Income vs. Number of Sources of Income

Income (in Ksh.) Number of Sources	*<60,000 out of 13*		*60,000-150,000 out of 15*		*>150,000 out of 2*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*
1	6	46.2	6	40	0	0
2	6	46.2	6	40	1	50
3	1	7.69	3	20	1	50

Farmers in the highest income bracket, greater than 150,000 Ksh., all belonged to households where there were at least two sources of income. 60% of the farmers in the second highest income bracket (60,000 - 150,000 Ksh.) also belonged to households where there were at least two sources of income. 46.2% of the farmers in the lowest income bracket resided in households where there were two sources of income and another 46.2% of these farmers belonged to households where there was only one source of income. Overall, it was observed that higher household incomes were positively associated with households that had numerous sources of income.

Table 6: Farmer's Sources of Income

Sources of Income	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Farming	10	100	5	100	8	100	7	100
Government Employee	0	0	0	0	0	0	1	14.3
Teaching	1	10	0	0	1	12.5	2	28.6
Apiculture	3	30	0	0	0	0	0	0
Other	3	30	2	40	4	50	2	28.6

All interviewees used farming as a major source of household income. 28.6% of the female non-project farmers also claimed that teaching was a major source of their household incomes. Apiculture was utilized as a source of income by only the male project farmers, 30% of them.

Table 7: Level of Education vs. Farmer's Sources of Income

Income Sources Years of Education	*Farming*		*Government Employee*		*Teaching*		*Apiculture*		*Other*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
None out of 1	1	100	0	0	0	0	0	0	1	100
1-4 out of 1	1	100	0	0	0	0	0	0	1	100
5-8 out of 12	12	100	0	0	0	0	1	8.33	6	50
9-12 out of 15	15	100	1	6.67	3	20	2	13.3	3	20
College & beyond out of 1	1	100	0	0	1	100	0	0	0	0

Farming was used as a major source of household income regardless of the level of education. However, as the amount of education increased, the probability of utilizing the teaching profession as a major source of income also increased. None of the farmers with eight or less years of education belonged to households where this profession was utilized. Yet, 20% of farmers with 9-12 years of education and 100% of farmers with a college degree or beyond belonged to households where teaching was used a major source of income. Only one household included a government employee. This was a household where the interviewee had received higher education (through high school).

Table 8: Farmer's Annual Household Income vs. Farmer's Sources of Income

Income (in Ksh.) Sources of Income	*<60,000 out of 13*		*60,000-150,000 out of 15*		*>150,000 out of 2*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*
Farming	13	100	15	100	2	100
Government Employee	0	0	0	0	1	50
Teaching	1	7.69	2	13.3	1	50
Apiculture	0	0	3	20	0	0
Other	5	38.5	5	33.3	0	0

Regardless of economic status, farming remained a major source of income for all households. The likelihood of teaching being as a major source of the household income increased as the level of income grew. 50% of the highest income bracket also utilized teaching as a major source of the household income. Another 50% of the households in that bracket included the salary received from government employment a major source of income. Apiculture was a prominent source of income for households in the 60,000 - 150,000 Ksh. income bracket with 20% of the households participating in the activity in order to generate income.

2.3.3 Cow Ownership with Reference to Education

Table 9: Level of Education vs. Local Cow Ownership

# of Local Cows Years of Education	*Doesn't Own Any Cows*		*None*		*1-5*		*6-10*		*11+*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
None out of 1	0	0	0	0	0	0	1	100	0	0
1-4 out of 1	0	0	0	0	1	100	0	0	0	0
5-8 out of 12	2	16.7	1	8.33	5	41.7	3	25	1	8.33
9-12 out of 15	2	13.3	1	6.67	7	46.7	2	13.3	3	20
College & beyond out of 1	0	0	0	0	1	100	0	0	0	0

100% of the farmers interviewed receiving between 1 and 4 years of education

and 100% of the farmers receiving a college degree or higher own between 1 and 5 local cows. Farmers having had between 5 and 8 years of education or at least some secondary education most often owned between 1 and 5 local cows as well. Only 20% of the farmers who had received at least some secondary education and 8.33% of the farmers who had 5-8 years of education owned 11 or more local cows.

Table 10: Level of Education vs. Grade Cow Ownership

# Grade Cows Owned Years of Education	*Doesn't Own Any Cows*		*None*		*1-5*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*
None out of 1	0	0	1	100	0	0
1-4 out of 1	0	0	1	100	0	0
5-8 out of 12	2	16.7	5	41.7	3	25
9-12 out of 15	2	13.3	6	40	7	46.7
College & beyond out of 1	0	0	1	100	0	0

Farmers who had received at least the higher levels of primary education were more likely to own grade cows. The only farmers interviewed that did own grade cows had either received 5-8 years of education or had gone on to secondary school, 25% and 46.7%, respectively. As the number of years of education the farmer had received increased, the probability that the farmer owned any grade cattle also escalated.

2.3.4 Farmer's Income from Milk Sales

Table 11: Annual Income from Milk Sales

Milk Income (in 1000s Ksh.)	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
< 25	5	50	2	40	3	37.5	1	14.3
25 – 50	2	20	1	20	0	0	0	0
> 50	1	10	2	40	0	0	0	0
Consumes All	2	20	0	0	2	25	3	42.9
Doesn't Produce Milk	0	0	0	0	3	37.5	3	42.9

Not a single non-project farmer produced enough milk to receive more than 25,000 Ksh, per year. 25% of the male non-project farmers and 42.9% of the female non-project farmers produced only enough milk for their own households. Another 37.5% of the male non-project farmers and 42.9% of the female non-project farmers didn't produce any milk at all. 30% of the male project farmers and 60% of the female project farmers produced enough milk to generate more than 25,000 Ksh. for their household every year. 10% and 40% of them, respectively, produced enough milk to generate an income of more than 50,000 Ksh. every year from milk sales alone.

Table 12: Level of Education vs. Annual Income from Milk Sales

Milk Income Years of Education	*< 25,000 Ksh.*		*25,000 -50,000 Ksh.*		*>50,000 Ksh*		*Consumes All*		*Doesn't Produce*	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
None out of 1	0	0	0	0	0	0	0	0	1	100
1-4 out of 1	0	0	0	0	0	0	0	0	1	100
5-8 out of 12	6	50	1	8.33	1	8.33	2	16.7	2	16.7
9-12 out of 15	5	33.3	2	13.3	2	13.3	5	33.3	1	6.67
College & beyond out of 1	0	0	0	0	0	0	0	0	1	100

100% of the farmers who had received no formal education, 1-4 years of education, or a college degree or beyond were unable to produce any milk. However, a positive relationship between the years of education and the income generated from milk sales still seems to exist. The majority of farmers having 5-8 years or 9-12 years of education produced enough milk to consume and sell. 16.7% and 26.7% of them, respectively, were even able to generate over 25,000 Ksh. annually.

Table 13: Farmer's Milk Income per Cow

Milk Income Per Cow	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
<1001 Ksh.	1	10	0	0	1	12.5	0	0
1001-1500 Ksh.	0	0	1	20	0	0	1	14.3
1501-2000 Ksh.	2	20	0	0	2	25	0	0
>2000 Ksh	3	30	4	80	0	0	0	0
Consumes All	20	20	0	0	2	25	3	42.9
Doesn't Produce Milk	2	20	0	0	3	37.5	3	42.9

The majority of non-project farmers, both male and female, did not sell any milk either because they consumed it all or were unable to produce it. Only 37.5% of the non-project males were able to sell milk, 12.5% of them generating less than 1001 Ksh. per cow annually, and the other 25% making between 1501 and 2000 Ksh. per cow annually. Only 14.3% of the female non-project farmers were able to sell milk, of which all made between 1001 and 1500 Ksh. per cow in one year. 60% of the male project farmers and 100% of the female project farmers were able to produce enough milk to sell. 30% of the male project farmers and 80% of the female project farmers produced enough milk in one year to generate more than 2000 Ksh. per cow.

Table 14: Level of Education vs. Farmer's Milk Income per Cow

Years of Education *Milk Income Per Cow*	None out of 1		1-4 out of 1		5-8 out of 12		9-12 out of 15		College & beyond out of 1	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
<1001 Ksh.	0	0	0	0	1	8.33	1	6.67	0	0
1001-1500 Ksh.	0	0	0	0	1	8.33	2	13.3	0	0
1501-2000 Ksh.	0	0	0	0	2	16.7	0	0	0	0
>2000 Ksh.	0	0	0	0	4	33.3	4	26.7	0	0
Consumes All	0	0	0	0	2	16.7	5	33.3	0	0
Doesn't Produce Milk	1	100	1	100	2	16.7	2	13.3	1	100

In most cases, as long as the farmer had at least gone through the higher years of primary education (5-8), they were able to produce enough milk to sell. 33.3% of the farmers with 5-8 years of education and 26.7% of the farmers with at least some secondary education were even able to generate more than 2000 Ksh. per cow annually from milk sales.

2.3.5 Farmer's Financial Status

Table 15: Farmer's Financial Status

Financial Status (per year)	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
In debt >50,000 Ksh.	1	10	0	0	2	25	1	14.3
In debt <50,000 Ksh.	6	60	5	100	3	37.5	4	57.1
Saves/Breaks Even	3	30	0	0	3	37.5	2	28.6

The majority of all of the farmers found themselves in debt annually. 60% of the male project farmers, 100% of the female project farmers, 37.5% of the male non-project farmers, and 57.1% of the female non-project farmers were normally in debt less than 50,000 Ksh. per year. The non-project farmers were more likely to have larger debts, but they were also more likely to save or break even every year. 30% of the male project farmers and none of the female project farmers were able to break even or save money annually, but 37.5% of the male non-project farmers and 28.6% of the female non-project farmers were also able to do so.

Table 16: Level of Education vs. Financial Status

Years of Education *Financial Status (per year)*	None out of 1 *Ratio*	*%*	1-4 out of 1 *Ratio*	*%*	5-8 out of 12 *Ratio*	*%*	9-12 out of 15 *Ratio*	*%*	College & beyond out of 1 *Ratio*	*%*
In debt >50,000 Ksh.	1	100	1	100	1	8.33	1	6.67	0	0
In debt <50,000 Ksh.	0	0	0	0	8	66.7	9	60	1	100
Saves/Breaks Even	0	0	0	0	3	25	5	33.3	0	0

100% of the farmers entirely lacking formal education or having only 1-4 years of education had debts of more than 50,000 Ksh. per year. 66.7% of the farmers with 5-8 years of education, 60% of the farmers with at least some secondary education, and 100% of the farmers with a college degree or higher had a small debt every year of less than 50,000 Ksh. 25% of the farmers that had received higher primary education and 33.3% of the farmers who had attended high school were able to break even or save money every year.

Objective 4: Education Level of Farmer's Household

2.4.1 Spouse's Level of Education

Table 1: Spouse's Level of Education

Spouse's Years of Education	MPF out of 10 *Ratio*	*%*	FPF out of 5 *Ratio*	*%*	MNPF out of 8 *Ratio*	*%*	FNPF out of 7 *Ratio*	*%*
None	0	0	0	0	1	12.5	0	0
1-4	0	0	0	0	0	0	0	0
5-8	5	50	1	20	6	75	2	28.6
9-12	5	50	4	80	0	0	3	42.9
College & Beyond	0	0	0	0	1	12.5	1	14.3
N/A	0	0	0	0	0	0	1	14.3

There were only two spouses, one male and one female, who had received a college degree. Both were married to non-project farmers. 50% of the male project farmers had wives who had received 5-8 years of education and another 50% of these men had wives with 9-12 years of education. 80% of the female project farmers had husbands who had received at least some secondary education. 75% of the male non-project farmers were married to women who had only 5-8 years of education. None of the male non-project farmers were married to women with any secondary education with the exception of the women who received a college degree. 57.2% of the female non-

project farmers were married to men who had received at least some secondary education.

Table 2: Farmer's Level of Education vs. Spouse's Level of Education

Farmer's Years of Education *Spouse's Years of Education*	None out of 1		1-4 out of 1		5-8 out of 12		9-12 out of 15		College & Beyond out of 1	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
None	0	0	1	100	0	0	0	0	0	0
1-4	0	0	0	0	0	0	0	0	0	0
5-8	1	100	0	0	10	83.3	3	20	0	0
9-12	0	0	0	0	2	16.7	10	66.7	0	0
College & Beyond	0	0	0	0	0	0	0	0	1	100
N/A	0	0	0	0	0	0	1	6.67	0	0

In the majority of households, farmers had spouses that were approximately equal to them in education. This was especially true when looking at the farmers with more years of education. 100% of the farmers who had a college degree or above, 66.7% of the farmers who had some secondary education, and 83.3% of the farmers who had attained higher levels of primary education (5-8) had all married people in the same education grouping as themselves.

2.4.2 Equality of Education in Marriage

Table 3: Education Equality in Marriage

Comparison of Education	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Male Higher	8	80	1	20	5	62.5	4	51.7
Female Higher	0	0	1	20	1	12.5	1	14.3
Equal	2	20	3	60	2	25	1	14.3
N/A	0	0	0	0	0	0	1	14.3

Regardless of participation status, the majority of male interviewees were more educated than their spouses. This was true with 80% of the male project farmers and 62.5% of the male non-project farmers. 51.7% of the female non-project farmers also resided in households where their male counterpart was more educated than themselves. However, 60% of the female project farmers were in a marriage where the levels of education were exactly equal. Also, 20% of the female project farmers were in a marriage in which they were the more educated one.

Table 4: Level of Education vs. Education Equality in Marriage

Years of Education *Comparison of Education*	None out of 1 *Ratio*	*%*	1-4 out of 1 *Ratio*	*%*	5-8 out of 12 *Ratio*	*%*	9-12 out of 15 *Ratio*	*%*	College & Beyond out of 1 *Ratio*	*%*
Male Higher	0	0	1	100	10	83.3	7	46.7	0	0
Female Higher	1	100	0	0	0	0	2	13.3	0	0
Equal	0	0	0	0	2	16.7	5	33.3	1	100
N/A	0	0	0	0	0	0	1	6.67	0	0

A direct relationship could be seen between the number of years of education and the likelihood of having complete equality of education in marriage. Although overall the male was normally more educated, 16.7% of the farmers with 5-8 years of education, 33.3% of farmers with 9-12 years of education, and 100% of the farmers with a college degree or beyond were all exactly equal in education to their spouses. 13.3% of the farmers with 9-12 years of education and 100% of the farmers completely lacking formal education admitted that the female in the marriage was more educated.

2.4.3 Influence of Children's Gender on Household Education Equality

Table 5: Education Equality Amongst Children of the Household

Comparison of Education	MPF out of 10 *Ratio*	*%*	FPF out of 5 *Ratio*	*%*	MNPF out of 8 *Ratio*	*%*	FNPF out of 7 *Ratio*	*%*
Sons Higher	1	10	0	0	0	0	0	0
Daughters Higher	1	10	0	0	0	0	0	0
Equal	6	60	4	80	7	87.5	4	51.7
N/A	2	20	1	20	1	12.5	3	42.9

Table 6: Level of Education vs. Children's Education Equality

Years of Education *Comparison of Education*	None out of 1 *Ratio*	*%*	1-4 out of 1 *Ratio*	*%*	5-8 out of 12 *Ratio*	*%*	9-12 out of 15 *Ratio*	*%*	College & Beyond out of 1 *Ratio*	*%*
Sons Higher	0	0	0	0	0	0	1	6.67	0	0
Daughters Higher	0	0	0	0	1	8.33	0	0	0	0
Equal	1	100	1	100	10	83.3	8	53.3	1	100
N/A	0	0	0	0	1	8.33	6	40	0	0

Gender sensitization has been a problem faced when trying to educate women in

Suba that are of the current adult generation. However, when it comes to the current generation of children, the inequality of education seems to be fading. The majority of farmers interviewed claimed that they wished for all of their children to be equally educated, regardless of their gender. Only one farmer, a male project farmer who had received at least some secondary education, educated his sons more than his daughters. There was only one farmer, a male project farmer with 5-8 years of education, who educated his daughters more than his sons.

Objective 5: Regional Health Issues

2.5.1 Major Health Problems

Table 1: Farmer's Major Health Problems

Major Health Problems	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
HIV/AIDS	10	100	2	40	4	50	4	57.1
Malaria	10	100	5	100	8	100	7	100
Typhoid	2	20	1	20	2	25	3	42.9
Poor Sanitation	3	30	3	60	1	12.5	2	28.6
Inadequate/ Unclean Water	3	30	2	40	0	0	3	42.9
Other	8	80	2	40	7	87.5	6	85.7

Table 2: Level of Education vs. Farmer's Major Health Problems

Years of Education Major Health Problems	None out of 1		1-4 out of 1		5-8 out of 12		9-12 out of 15		College & Beyond out of 1	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
HIV/AIDS	1	100	0	0	6	50	11	73.3	1	100
Malaria	1	100	1	100	12	100	15	100	1	100
Typhoid	0	0	0	0	2	16.7	5	33.3	1	100
Poor Sanitation	0	0	1	100	2	16.7	6	40	0	0
Inadequate/ Unclean Water	0	0	0	0	2	16.7	9	60	0	0
Other	1	100	0	0	9	75	11	73.3	1	100

All farmers, regardless of participation status, educational background, and gender, readily agreed that malaria was a rampant problem in the region. However, Suba District has one of the highest HIV/AIDS rates in Africa, but this wasn't as easily admitted by the farmers. While 100% of the male project farmers admitted this fact, only 40% of the female project farmers, 50% of the male non-project farmers, and 51.7% of

the female non-project farmers did so. In terms of education, 100% of the farmers with either no education or a college degree or beyond admitted that HIV/AIDS was a major regional problem. Yet, all of the farmers with 1-4 years of education, 50% of the farmers with 5-8 years of education, and 73.3% of the farmers with at least some secondary education wouldn't admit that HIV/AIDS was a major problem. A positive relationship between the farmer's level of education and their willingness to talk about HIV/AIDS was observed.

2.5.2 Knowledge of Malarial Carrier

Table 3: Farmer's Awareness of the Cause of Malaria

Cause of Malaria	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Mosquitoes	10	100	5	100	8	100	6	85.7
Cold Weather	0	0	0	0	0	0	1	14.3
Unclean Water	1	10	0	0	0	0	0	0

Table 4: Level of Education vs. Farmer's Awareness of the Cause of Malaria

Years of Education *Cause of Malaria*	None out of 1		1-4 out of 1		5-8 out of 12		9-12 out of 15		College & Beyond out of 1	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Mosquitoes	1	100	1	100	11	91.7	15	100	1	100
Cold Weather	0	0	0	0	1	8.33	0	0	0	0
Unclean Water	0	0	0	0	0	0	1	6.67	0	0

Only one farmer, a female non-project farmer with 5-8 years of education, was unaware that the malarial parasite was spread by mosquitoes. One farmer, a male project farmer with 9-12 years of education, believed that a person could contract malaria by coming into contact with unclean water in addition to a mosquito bite.

Table 5: Farmer's Knowledge on a Mosquito's Lifecycle

Farmer's Knowledge	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
None	3	30	2	40	5	62.5	4	57.1
Partial	3	30	2	40	1	12.5	1	14.3
Complete	4	40	1	20	2	25	2	28.6

The majority of non-project farmers, 62.5% of the males and 57.1% of the females, had no knowledge of the mosquito's lifecycle what-so-ever. The project farmers were more likely to have information on some or even all of the mosquito's lifecycle. 70% of the male project farmers and 60% of the female project farmers had at least

partial knowledge on the lifecycle of a mosquito.

Table 6: Level of Education vs. Farmer's Knowledge on a Mosquito's Lifecycle

Years of Education *Farmer's Knowledge*	None out of 1 *Ratio*	*%*	1-4 out of 1 *Ratio*	*%*	5-8 out of 12 *Ratio*	*%*	9-12 out of 15 *Ratio*	*%*	College & Beyond out of 1 *Ratio*	*%*
None	1	100	1	100	5	41.7	6	40	1	100
Partial	0	0	0	0	2	16.7	5	33.3	0	0
Complete	0	0	0	0	5	41.7	4	26.7	0	0

As the farmer's educational status increased, the likelihood of them being aware of the lifecycle of a mosquito also increased. The majority of farmers who had received higher levels of education, 58.4% of the farmers with 5-8 years of education and 60% of the farmers with at least some secondary education, knew at least some of the lifecycle of the mosquito. 41.7% of the farmers with 5-8 years of education and 26.7% of the farmers with at least some secondary education even knew the complete lifecycle.

2.5.3 Frequency of Malaria

Table 7: Average Annual Rate of Malaria Contraction per Member of a Farmer's Household

Rate of Contraction	MPF out of 10 *Ratio*	*%*	FPF out of 5 *Ratio*	*%*	MNPF out of 8 *Ratio*	*%*	FNPF out of 7 *Ratio*	*%*
1-4	7	70	2	40	7	87.5	3	42.9
5-8	2	20	0	0	0	0	1	14.3
9-12	0	0	3	60	0	0	0	0
13-16	0	0	0	0	0	0	2	28.6
>16	1	10	0	0	1	12.5	1	14.3

Table 8: Level of Education vs. Average Annual Rate of Malaria Contraction per Member of a Farmer's Household

Years of Education *Rate of Contraction*	None out of 1 *Ratio*	*%*	1-4 out of 1 *Ratio*	*%*	5-8 out of 12 *Ratio*	*%*	9-12 out of 15 *Ratio*	*%*	College & Beyond out of 1 *Ratio*	*%*
1-4	1	100	1	100	10	83.3	7	46.7	0	0
5-8	0	0	0	00	0	0	3	20	0	0
9-12	0	0	0	0	1	8.33	3	20	0	0
13-16	0	0	0	0	0	0	1	6.67	0	0
>16	0	0	0	0	1	8.33	1	6.67	1	100

70% of the male project farmers, 87.5% of the male non-project farmers, and 42.9% of the female non-project farmers claimed that a single member of the household may contract malaria between one and four times in a year. 60% of the female project farmers admitted that a single family member may contract malaria between nine and twelve times in one year, on average. 100% of the farmers lacking formal education, 100% of the farmers with 1-4 years of education, 83.3% of the farmers with 5-8 years of education, and 46.7% of the farmers with at least some secondary education stated that a single family member may contract malaria one to four times in a year, on average. However, 100% of the farmers with a college degree or above asserted that a member of the household may contract malaria more than 16 times annually.

2.5.4 Farmer's Methods of Control for Malaria

Table 9: Farmer's Methods of Control for Malaria

Methods of Control	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Medicines	2	20	4	80	4	50	6	85.7
Local Plants	9	90	4	80	6	75	4	57.1
Burning Animal Dung	1	10	3	60	1	12.5	0	0
Repellent Spray	1	10	1	20	1	12.5	0	0
Bed nets	8	80	4	80	6	75	5	71.4
Other	3	30	3	30	0	0	4	57.1

Project farmers were more likely to utilize the inexpensive, but yet very effective, local plants to repel malaria-carrying mosquitoes. Only two project farmers didn't use the plants, whereas, 33.3% of the non-project farmers didn't use the plants. The female farmers, regardless of participation status, seemed to rely more on medicines than the male farmers. 80% of the female project farmers and 85.7% of the female non-project farmers utilized medicines, whereas only 20% of the male project farmers and 50% of the male non-project farmers admitted to doing so.

Table 10: Level of Education vs. Farmer's Methods of Control for Malaria

Years of Education *Methods of Control*	None out of 1 *Ratio*	*%*	1-4 out of 1 *Ratio*	*%*	5-8 out of 12 *Ratio*	*%*	9-12 out of 15 *Ratio*	*%*	College & Beyond out of 1 *Ratio*	*%*
Medicines	1	100	1	100	6	50	7	46.7	1	100
Local Plants	1	100	1	100	8	66.7	12	80	1	100
Burning Dung	0	0	0	0	3	25	2	13.3	0	0
Sprays Repellent	0	0	0	0	1	8.33	2	13.3	0	0
Bed nets	0	0	0	0	10	83.3	12	80	1	100
Other	0	0	0	0	2	16.7	8	53.3	0	0

Bed nets are one of the simplest methods of malaria prevention, but none of the farmers lacking a formal education or having only 1-4 years of education utilize this tool. However, 83.3% of the farmers with 5-8 years of education, 80% of the farmers with 9-12 years of education, and 100% of the farmers with a college degree or beyond used bed nets. Yet, regardless of the level of education, the utilization of local plants to repel mosquitoes was a predominant technique amongst the farmers. 100% of the farmers lacking education, 100% of the farmers with 1-4 years of education, 66.7% of the farmers with 5-8 years of education, 80% of the farmers with 9-12 years of education, and 100% of the farmers with a college degree or beyond used bed nets as a method of prevention.

Objective 6: African Poverty

2.6.1 Farmer's Beliefs of the Causes of the Continent's Poverty

Table 1: Causes of Poverty in Africa

Causes of Poverty	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Poor Infrastructure	2	20	2	40	0	0	3	42.9
Poor Markets	4	40	3	60	1	12.5	2	28.6
Poor Finances (plans, invest, etc.)	1	10	2	40	2	25	3	42.9
Lack of Education	4	40	2	40	3	37.5	4	57.1
Large Families	1	10	2	40	3	37.5	1	14.3
Lack Credit of Facilities	1	10	1	20	0	0	0	0
Inefficient Use of Resources	1	10	2	40	4	50	2	28.6
Laziness	4	40	1	20	3	37.5	1	14.3
No Employment Opportunities	4	40	2	40	1	12.5	1	14.3
Weather	7	70	1	20	2	25	3	42.9
Other	8	80	3	60	6	75	3	42.9

The majority of farmers interviewed had their own unique beliefs as to exactly why poverty existed in Africa. However, 70% of the male project farmers believed that the weather, lack of rain and drought in particular, was one of the main causes of poverty. 60% of the female project farmers believed that one of the main causes of poverty in the entire continent was the poor market for farm produce. 50% of the male non-project farmers believed that the inefficient use of resources was one of the main causes, and 57.1% of the female non-project farmers blamed the lack of education, including practical training and education in specific skills.

Table 2: Level of Education vs. Causes of Poverty in Africa

Years of Education *Causes of Poverty*	None out of 1 *Ratio*	*%*	1-4 out of 1 *Ratio*	*%*	5-8 out of 12 *Ratio*	*%*	9-12 out of 15 *Ratio*	*%*	College & Beyond out of 1 *Ratio*	*%*
Poor Infrastructure	0	0	0	0	2	16.7	5	33.3	0	0
Poor Markets	1	100	0	0	3	25	6	40	0	0
Poor Finances (plans, invest, etc.)	0	0	0	0	4	33.3	3	20	1	100
Lack of Education	1	100	1	100	5	41.7	4	26.7	0	0
Large Families	0	0	1	100	4	33.3	3	20	0	0
Lack Credit of Facilities	0	0	0	0	2	16.7	0	0	0	0
Inefficient Use of Resources	0	0	1	100	3	25	4	26.7	1	100
Laziness	0	0	0	0	5	41.7	4	26.7	0	0
No Employment Opportunities	0	0	0	0	3	25	5	33.3	0	0
Weather	0	0	0	0	3	25	10	66.7	0	0
Other	1	100	1	100	7	58.3	10	66.7	1	100

Regardless of education, once again almost all of the farmers had their own unique views on the causes of poverty in Africa. 100% of the farmers lacking any formal education named poor markets as one of the main causes of poverty. Along with 100% of the farmers with 1-4 years of education and 41.7% of the farmers with 5-8 years of education, they also blamed a lack of education and training in specific skills as another cause of poverty. 100% of the farmers with 1-4 years of education named larges families as yet another cause. Also, 100% of the farmers with 1-4 years of education and 100% of the farmers with a college degree or beyond blamed the inefficient use of resources as a cause. 41.7% of the farmers with 5-8 years of education claimed that laziness was a primary cause of poverty in the continent, and 66.7% of the farmers with at least some secondary education blamed the erratic weather patterns. Finally, 33.3 % of the farmers with 5-8 years of education, 20% of the farmers with 9-12 years of education, and 100% of the farmers with at least a college degree named poor financial planning as yet another main reason for poverty in Africa.

2.6.2 Farmer's Suggestions to Alleviate Poverty in Africa

Table 3: Farmer's Solutions to Poverty

Solutions to Poverty	MPF out of 10		FPF out of 5		MNPF out of 8		FNPF out of 7	
	Ratio	*%*	*Ratio*	*%*	*Ratio*	*%*	*Ratio*	*%*
Availability of Loans & Credit Facilities	7	70	3	60	1	12.5	3	42.9
Govt. Grants	2	20	2	40	1	12.5	3	42.9
Improved Health Facilities	4	40	2	40	2	25	2	28.6
Affordable Farm Implements	2	20	2	40	1	12.5	0	0
Specialized Education/Training	8	80	3	60	7	87.5	6	85.7
Improved Markets	3	30	1	20	4	50	3	42.9
Produce Processing Facilities	0	0	1	20	0	0	1	14.3
Storage Facility Availability	4	40	1	20	0	0	0	0
Improved Infrastructure	4	40	2	40	0	0	1	14.3
Other	7	70	2	40	7	87.5	4	57.1

The majority of farmers had their own unique suggestion as to what the governments and non-government organizations (NGOs) of Africa should do to help alleviate poverty. 70% of the male project farmers, 60% of the female project farmers, and 42.9% of the female non-project farmers believed that making loans and credit facilities more available would help the current predicament. 50% of the male non-project farmers and 42.9% of the female non-project farmers also believed that improved markets would help the poverty dilemma in Africa. The main belief of all farmers of what would help to reduce poverty in the continent dealt with education. 80% of the male project farmers, 60% of the female project farmers, 87.5% of the male non-project farmers, and 85.7% of the female non-project farmers believed that improving education and providing training in specific topics and skills rather than just broad knowledge would help to decrease poverty in Africa as a whole.

Table 4: Level of Education vs. Farmer's Solutions to Poverty

Years of Education *Solutions to Poverty*	None out of 1 *Ratio*	 *%*	1-4 out of 1 *Ratio*	 *%*	5-8 out of 12 *Ratio*	 *%*	9-12 out of 15 *Ratio*	 *%*	College & Beyond out of 1 *Ratio*	 *%*
Availability of Loans & Credit Facilities	0	0	0	0	6	50	8	53.3	0	0
Govt. Grants	1	100	0	0	4	33.3	3	20	0	0
Improved Health Facilities	0	0	0	0	4	33.3	6	40	0	0
Affordable Farm Implements	0	0	0	0	2	16.7	3	20	0	0
Specialized Education/Training	1	100	1	100	9	75	12	80	1	100
Improved Markets	1	100	0	0	6	50	4	26.7	0	0
Produce Processing Facilities	0	0	0	0	1	8.33	1	6.67	0	0
Storage Facility Availability	0	0	0	0	0	0	1	6.67	0	0
Improved Infrastructure	0	0	0	0	1	8.33	6	40	0	0
Other	1	100	1	100	6	50	12	80	1	100

Once again, almost all farmers, regardless of educational background, had their own unique suggestions to solve the dilemma of poverty in the continent. Overall, the majority of farmers, 80% of all of the farmers interviewed, believed that the main solution to the problem of poverty would be education. 100% of the farmers completely lacking formal education, 100% of the farmers with 1-4 years of education, 75% of the farmers with 5-8 years of education, 80% of the farmers with 9-12 years of education, and 100% of the farmers with at least a college degree all believed that providing specialized education and practical training in a variety of special skills would be key in alleviating poverty in Africa.

ANALYSIS OF RESULTS

ANALYSIS OF RESULTS

Since 1997, the Gatsby Project and its many collaborators have attempted to spread knowledge and increase farmers' awareness of efficient agricultural techniques throughout Suba District. Considered the poorest district in the entire nation of Kenya, the work of Dr. Khan and his research partners have proven to be vital in the lives of the numerous subsistence farmers that Suba is comprised of. This study represents the differences between farmers who have utilized the help of the Gatsby Project and its push-pull technology in comparison to the farmers who have yet to adopt the technology. This survey also analyzes the influence of education in project participation and the overall lifestyles of the farmers of Suba District, Kenya.

Basically all of the farmers in Suba District are subsistence farmers, selling only the surplus of their produce. Therefore ensuring that their crop is healthy and produces sufficient yields is very important to these farmers. All of the farmers interviewed named maize and sorghum as their main crops, and therefore, their family's main source of food. In most cases, the farmer had received at least five years of formal education, but project farmers were more likely to have completed even their secondary education.

The obstacle of ensuring abundant yields is one of the biggest challenges to the farmers of Suba District. Unlike other districts in Kenya, and other regions in Africa, Suba has many set backs due to the lack of many natural resources, soil infertility, and the erratic weather conditions. However, the number one constraint to crop growth named by all of the interviewed farmers, with the exception of 10% of the male project farmers and 14.3% of the female non-project farmers, was the notorious striga weed, more commonly known as '*kayongo'* by the locals. The second leading constraint to crop production in the region is the stemborers, also known as '*kundy*' by the local farmers.

Usually striking simultaneously, '*kayongo'* and '*kundy'* wreak extreme havoc upon the farmer's crops, their yields, and, most importantly, their household food security. To help evade this problem, the Gatsby Project is trying to expediently spread the effective push-pull strategy. The main benefit cited by the project farmers thus far is the increase in the crop yields, therefore increasing the farmer's household food security.

Another important advantage of the technology has been the ability to utilize the push-pull grasses as high-quality fodder for cattle. About 80% of the female project farmers and 30% of the male project farmers have even increased their milk production by thousands of shillings because of the use of Napier Grass as fodder. One of the major causes of poverty in Suba has been the inefficient use of resources. Utilizing the various components of the push-pull technology individually has helped to drastically increase the overall resource-efficiency of farmers in the district.

Another major component of farming in Suba is the livestock. Unfortunately there are many challenges that the farmer must overcome in this area as well. The

number one concern named by almost all of the farmers is the attack of the tsetse fly, which frequently infects the livestock with the lethal trypanosomiasis (also known as *"Nagana"* by the local farmers). To help control the impact of the tsetse, the Ngu-trap has been distributed to households throughout the district, but isn't utilized by a large majority of the farmers (60% of the male project farmers, 20% of the female project farmers, 75% of the male non-project farmers, and 85.7% of the female non-project farmers). The biggest restraint to using this effective method of control is ignorance in regards to the tsetse trap.

In Africa, the females of the household carry the majority of the agricultural burdens. Therefore, they are often the individuals that need to be reached with information on new agricultural techniques and education on the skills that would increase the farmer's efficiency and food security. ICIPE was found to be the main source of information on the new agricultural technologies and methods for all classifications of farmers, but it was often found to be more accessible to the male farmers rather than the females. Within the households, equality of education was rarely seen. In the majority of cases, the male head of the household was by far more educated than their female counterpart. However, in the few households in which women were well-educated, the household income and food production were at much higher rates. The success of the household was seen to be more dependent on the level of education of the head woman in the household more than other member of the household, including the male head.

Suba District is notorious for having the highest HIV/AIDS rate in Kenya, one of the highest rates in Africa, and even in the world. However, many farmers interviewed were extremely uncomfortable to even broach the topic. It was noted, though, that as the level of education of the farmer and the farmer's awareness of the disease increased, their willingness to mention, and sometimes even discuss, its impact on the region also increased. The willingness to openly recognize that HIV/AIDS is a severe problem is pertinent to helping its prevention. By uninhibited recognition of the problem, the overall awareness for all people in the region will increase. Knowledge is often viewed as a cure-all. In this instance, that very cure-all could help decrease the rate of occurrence of this virulent epidemic.

Another health threat faced by the people of Suba is malaria. The first step in preventing the contraction of malaria is to understand what it is, how it is spread, and to know basic information about the vector through which it is spread. However, the majority of non project farmers, and even a few project farmers, participating in the study were utterly clueless about much of this basic information.

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

In life we face many challenges, and the farmers of Africa can easily attest to that. Each of these obstacles that we must overcome can be represented as a closed door. Every one of these closed doors is locked by a key as unique as each individual on Earth. Education is like a key chain on which rests a key for each of those numerous closed doors that we come across on our journey through life. By acquiring specific knowledge, we are gaining access to yet another key on that key chain. By becoming empowered in various areas, we are able to unlock a variety of doors. When it comes to the farmers in Africa, the main problem that they face is that they don't have access to the correct keys that can unlock the doors that they are constantly encountering. All of the required keys exist, but many of the farmers are just unable to receive the ones that they need.

During one afternoon of interviewing people in the village of Miyal, a group of non-project farmers approached me with their thoughts. One farmer in the group stated, "We need extension services. The services that are given are made to look more far-reaching than they really are. In truth, the extension officers only reach the same people in the higher social classes over and over again. They totally ignore us, the poor farmers that need the help." But this is far from being the only obstacle that must be overcome in regards to empowering the farmers of Suba District.

When it comes to farm work in most households, the females are charged with the chores and many of the agricultural tasks. As demonstrated in the study results, the success of the household even depends on the woman's role and her level of awareness. Unfortunately, as the study results also revealed, the women are more than often the individuals in the household that lack the information on new agricultural technologies and more efficient methods. Overcoming these cultural barriers is a challenge that we need to surpass. Matilda Auma Ouma, Ecological Trainer in the ICIPE-Biovision Technology Transfer Unit, stated one morning while we were out doing interviews with the poorer female farmers of Lambwe Valley, "Social norms exist that often prevent us from reaching our targets, the women who need and want to implement the agricultural technology."

Nancy Ng'ang'a, a social scientist at the Kenya Agricultural Research Institute (KARI) in Tigoni, Kenya, discussed the woman's situation with me. She told me, "The women are scared to defy the men. And in turn, the men are scared to have educated women." When she said that, I recalled how one of the male non-project farmers I had interviewed had once stated that he would never marry a woman more educated, or even equally educated, than him because then he "would loose control of the household and be abused by the woman." Nancy continued, "In order to reach the women with the vital information they need for their food production, we must operate through the men. Otherwise, the woman's fear of not listening to her husband's rules overcomes her desire to learn." In a world in which knowledge is essential to survive, scaring those who need the information out of receiving it is a problem we should be ashamed to have, but, yet,

must still overcome.

As I was working in the various villages, interacting with the people and learning of the local culture, which I had assumed would be so different from the society I'm used to, I realized that there were in fact many similarities. For instance, there were numerous superstitions, myths, and misconceptions that ruled the lives of the locals. Unfortunately, though, many of these false beliefs hindered the very success of the farmer's households. In Kenya, success is defined differently from the connotation that I'm used to. In the United States, success is achieving something extra, accomplishing a goal or a dream. However, to the residents of Suba District, success means only one thing, that you were able to survive. With such dire consequences if one is unsuccessful, we have to battle the misconceptions and myths to ensure that they don't impede the mere survival of the people of Suba.

Poverty and a lack of household food security go hand-in-hand, often the former resulting in the latter. Therefore, I wasn't too astonished to discover that Suba District, one of the poorest places in Kenya and even Africa, was also known for poor nutrition and hunger. Health problems relating to a lack of nutritional awareness and to the spread of diseases are prevalent throughout the region. These are additional dilemmas frequently faced by the farmers in Suba, and we must help to combat them.

We have identified several of the problems that exist, but now we must concentrate on exactly how to counter these problems. Therefore, we come across the two main questions that we must answer: 1) Which knowledge is essential to ensure a farmer's household food security, and 2) how can we disperse the vital information to the people that need it the most? To answer both of these questions and alleviate many of the food security problems, there are several steps that need to be taken:

1) **Specialized Education:** When analyzing both the causes of poverty and the solutions to poverty in Africa, almost all of the farmers expressed a dire need for education. Although the formal education received in schools was often connected with the successful farmers in the region, practical education in specific skills is also extremely important for the inhabitants of Suba to receive. The most successful farmers involved in the study had not only received a good foundation in education through schooling, but they also received additional knowledge covering a variety of topics via several different sources. These sources included ICIPE, neighbors, and the Ministry of Agriculture. From these external sources, the farmers were able to gather information on better agricultural techniques, but there are still many more things to be learned. There are several ways to provide outreach in specialized education to the farmers of Suba. For instance, Barazas (town council meetings) could easily be used to disperse information to the whole community! By holding small-scale meetings and allowing for practical training, the farmers of Suba could become empowered in much of the knowledge that could ensure their success.

2) **Extending Extension Services:** As the group of non-project farmers in Miyal

pointed out, the extension services need to go further than they actually are. Currently, they are ignoring many of the farmers who truly need their help. By receiving these services, the farmers would be able to get information on how to improve their produce, their yields, and their lifestyles overall. Reaching the people who need the information the most should be the number one goal of the extension officers. The mere availability of the services should be publicized in all areas more than it currently is. We have to ensure that all of the farmers know that the extension officers are available to aid in their empowerment.

3) **Empowering Women:** Since the women in Africa are known to run the household and often complete the agricultural tasks, they need to be educated just as much as the men, if not more so. The problem, though, arises in attempting to reach the women in order to provide them with the knowledge they could utilize. As Nancy mentioned, we have to operate through the men to reach the women. Therefore, we have to involve the husbands in our efforts to educate the females. While we may be concentrating on empowering the women, we must also work alongside their male counterparts and make the men realize that this education will have a positive outcome. However, there are many circumstances in which this option is not always feasible. Another step that can be taken is to operate through the numerous women's groups in Africa. These groups are formed by the females as a kind of mini-community in which they aid and educate each other. By bringing our new technology and information to the groups, we can reach the women with the vital knowledge that could improve their household food security.

4) **Combating Myths and Misconceptions:** While we may present the new technologies to the local farmers, it's up to them to see the advantages and decide to adopt them. When talking to the farmers themselves, I realized that many of them have not adopted 'push-pull' technology. Professor Ahmed Hassanali, head of ICIPE's Behavioral and Chemical Ecology Department, provided one scenario: "Some African farmers believe that a field of crops should be clear of everything except for their maize, sorghum, or whatever it is that they are growing. If their field contains weeds or even grasses, they fear being labeled as lazy." Since one of the main components of push-pull is planting grasses around the field of crops, this very belief that only a lazy man's field contains grass could hinder many farmers from using this and many other valuable agricultural techniques. This is far from being the only impediment the farmers face in taking full advantage of their resources. For instance, there has been a decrease in the growth of many indigenous crops that have proven to be highly nutritious, especially in comparison to what is more frequently grown today. One female non-project farmer commented to me, "I do not grow them (the indigenous crops) because many people blame them for bringing '*kayongo'* (striga)." We have to direct our attention to setting aside these fears and ensuring that the farmers are aware of the accurate information so that they may help themselves.

5) **Increasing Financial Acumen:** In developed nations, the household income is

closely watched. Tax forms, population censuses, and several studies ask for this information, and it is usually easily available. However, when conducting this study in Africa, I found that trying to get accurate information on a farmer's household income was one of my principal challenges. The farmers were willing to help in anyway they could, but the problem resided in the fact that none of them had ever calculated their income, let alone kept track of it. Most were totally unaware of what their annual incomes even were! Thus, it came as no surprise to discover that the majority of farmers in Suba found themselves in debt every year. They are unsure of how much money they have, so they have no clue as to where to limit their expenditures. In a manner of speaking, the lack of financial planning and awareness for the farmers is in fact one of the major causes for their poverty. Educating the farmers on the importance of keeping financial records and increasing their fiscal knowledge could be one of the most helpful services we could offer to help alleviate poverty and increase household food security.

6) **Nutrition Education:** One of the visions that has distressed me the most since I first arrived in Kenya is the sight of the numerous malnourished children. Surprisingly, it is not always the poorest children that are the most undernourished. While some households have an adequate supply of food to feed their families, the children sometimes are still suffering because they aren't receiving the proper nutrition their bodies require. Every day as I went from village to village interviewing various households, I would see a number of stands run by females selling a small, minnow-like fish called '*omena*' by the local Luo tribe. On one particular sighting, Matilda pointed to the fish and said, "This fish is one of the cheapest and most nutritious foods, but it is ignored by many families because of sheer ignorance. They think that because it is small, it is not healthy, and, therefore, a poor man's food." Suba sits right on Lake Victoria, where the '*omena'* are so abundant, that they could provide sufficient nutrition to the thousands of Suba's malnourished inhabitants. Yet, the people won't accept this food that is so vital to their survival because of ignorance. Information on nutrition is desperately needed and dispersing this knowledge is a major step towards securing household food security for these farmers.

7) **Awareness of Health Issues:** Paris is known as the 'City of Romance.' The United States is known as the 'Melting Pot.' Suba also has a few nicknames, one of which is the Malarial Sphere. The parasite is rampantly spread through mosquitoes and has become so common that the locals contract it more frequently than they do the common cold. Malaria, however, is far from being the biggest health issue in Suba. HIV/AIDS is the pandemic causing millions of children to be orphaned throughout Africa, and Suba is no exception. The district has one of the highest rates of cases in the continent, and the number of victims struck down continues to escalate. It is estimated that three out of every ten people in the district is infected with the retrovirus, but that includes the extremities of the young and the old. Looking solely at the adult population, the group that consists of the majority of the disease's victims, the infection ratio increases to

approximately six out of every ten people. As these farmers are dying from HIV/AIDS, the level of food production decreases and the farmer leaves numerous hungry mouths needing the produce behind, now orphaned. The main way we can work towards preventing the spread of this lethal virus is to bring awareness to the people. Once again, ignorance is having a horrible effect on mankind, so we must work towards eradicating it.

8) **Government's Role:** During my first week in Kenya, a female project farmer named Mary Rabilo directly pointed out to me during an interview just how fortunate Americans were. She said, "You people are so lucky. If you cannot pay the school fees, if you are hungry, or whatever, your government takes care of you. Here if you do not have even the basic necessity of food, then the government will let you starve." The government of Kenya can no longer have such a passive role. There are several things on their agenda that need to be attended to. First of all, the overall infrastructure in the country is horrible. Farmers' produce are completely wasted because they are unable to transport them to market on the available roads that are made up of nothing but sand and rocks. One of the first experiences I had on the roads of Suba was passing an empty truck reeking of an exceedingly offensive odor. The truck had been transporting fish until it had gotten stuck on its way, and now, the fish had all rotted. The only thing the fisherman had left was a stench-filled cargo. Even if the fish had gotten to the market, the prices are shockingly low and would have been amazingly unfair to the producer. This too needs to be addressed. Strengthening of these weak markets must be a top priority. Another problem that farmers have is a lack of resources. Farm implements, such as good storage facilities for the farmer's excess produce is needed, but scarce in Suba. Frequently farmers have no choice but to sell their surplus crops to retailers for extremely minimal prices, and then end up buying back the very same crops later in the year for three times as much! Many of the farmers only require a loan to purchase their farm implements, but credit facilities normally aren't open to them. Therefore, the government could offer aid in the form of start-up grants or even low-interest loans. By taking these simple steps, the national governments in Africa can help to increase the self-sufficiency of their own people, fight poverty, and increase household food security.

"I never let schooling interfere with my education." This was stated by author Samuel Clemens, better known as Mark Twain, several decades ago. Although this quote overruns with sarcasm and was created in a more humorous tone, these words hold an underlying truth. Many of the components of a good education aren't taught in school, but still need to be learned. Whenever I used to think of education, my mind would automatically jump into school mode. After coming to Africa, I have realized that much of the true education needed for survival and prosperity in this region is ignored in schools. Through this study, the true importance of education in a variety of specific areas and the role it can play in helping to increase household food security is exposed. Specialized education and practical training in proper agronomic methods is required for both men and women, and we must ensure that we are reaching everyone who needs

assistance and not just the higher socioeconomic classes. We need to guarantee that the people are receiving accurate knowledge. We have to work towards ensuring that the farmers' misconceptions and superstitions do not hinder their progress towards achieving household food security. Information on financial planning and nutrition need to be disseminated throughout the continent. It is pertinent that awareness of the various regional health issues is increased. Finally, the governments need to take a more active role in helping to alleviate poverty in Africa.

Knowledge is the most valuable gift that can ever be given, but it does take time for the recipient to properly unwrap. Implementing so many changes will take time, but it is an important effort to make. Education is the key that can unlock any door. Let's use education to open the door to universal household food security.

PERSONAL PERSPECTIVE

PERSONAL PERSPECTIVE

"Only solitary men know the full joys of friendship." This was written by Willa Cather in her novel *Shadows on the Rock* in 1931. During the two months that I spent in Kenya, I learned just how true the sentiment of this quote really is. When I first set foot in Nairobi, I expected an adventure, but the experience I received was well beyond my wildest dreams. My first three nights in Kenya were spent in ICIPE Nairobi. I had been informed that my internship would take place in another branch of ICIPE, Mbita Point Field Station in Mbita Village, but I had no other knowledge of the region. During my three days in Nairobi I was continuously warned of the solitude, and lack of civilization, that I would be experiencing in the following two months. My new friends in Nairobi constantly worried about whether I could face the two lonely months that supposedly awaited me. On the long drive from Nairobi to Mbita, Dr. Khan stated, "I hope you packed plenty of books. Besides work, there is nothing else to do in Mbita." Yet, as we drove away from Nairobi, and civilization, I began a journey of discovery that would last for the next two months, two months that can be labeled as almost anything but lonely.

As we drove closer and closer to Mbita, my excitement grew and my curiosity had taken over. My first memory from this village that quickly became my second home caused the fears of solitude to completely vanish from my mind. As we drove into the surroundings of Mbita, my eyes viewed a sea of waving hands and kind faces, from small children to grown adults. People stopped their work to give a quick smile and wave my way. As I entered the village I received a greeting more grandiose than any that I had experienced in Nairobi. I never did find the loneliness and boredom that I had been continuously warned about. In fact, I found myself more occupied and entertained in the miniscule village than I had in the comparatively colossal city of Nairobi. In the fast-paced world of Nairobi everyone was too busy to be social or even to enjoy the simple joys of life. In the solitude of Mbita I found myself learning new things, participating in an unique culture, being renamed, and making friends and memories that would last forever.

My first night in Mbita, I was filled with disbelief at the wonderful opportunity that lay before me. I wandered around the beautiful scenery, looking for something to satisfy my curiosity. That night I discovered what came to be known as "Akyni's Cove" by my friends and family in Kenya. It was a small grove of trees that sat upon a soft rolling hill that led down to the edge of Lake Victoria. I frequently visited this favorite spot of mine to write, to read, to talk with friends, or even to just watch the beautiful landscape. During my stay in Mbita I was given the nickname Akyni, child of the morning. Thus, my cove received its name. From there I had the perfect view of Magic Town. Every night, immediately after the sun fell below the horizon, a plethora of fishermen would sit atop of the lake to catch the omena fish that much of the region's people relied on for sustenance. Upon their boats would hang small lanterns to light their way in the darkness. This beautiful city of lights that emerged every night upon the lake would disappear before the first streaks of sun cut through the early morning sky. Thus,

the Luo people had affectionately dubbed the spectacle as Magic Town.

Every day as I would walk to my office, I would pass by the Mbita Point International School. Students in grades one through eight would see me pass by several times a day and stop me for a conversation. Almost every evening on my way home I would find two 13-year-old girls, Irene and Diana, waiting to escort me. I extremely enjoyed being around the students. Eventually, I was even given the opportunity to teach classes at the school! Every day at 3:00 PM I would make my way to the middle school classroom where I would swim in math problems for the next one and a half-hours. Sometimes in the evenings I would interact with the higher level students to help improve their English. The first day after I had dismissed my class, I wondered what I had gotten myself into. It had been a day of frustrations, as the cultural gap between the students and me had become apparent. However, throughout the rest of my time as a teacher, I discovered that I had only gotten myself involved in one of the most rewarding experiences of my life. The look upon a child's face when they finally grasp that hard objective that had been evading them all along is the biggest compliment of all. Seeing my pupils becoming excited over understanding a concept would brighten my whole day. Although I was the one being referred to as Teacher Megan, I learned just as much, if not more, from my students as they did from me.

The first four weeks of my research I spent visiting farmers and various villages throughout Suba District. Everyday as we drove along the same roads I would see familiar faces that would cry out, "Ichionaday, mzungu (how are you, white person)?" Being an Indian with black hair and tan skin, I had never imagined that I would be referred to as a white person! Utilizing the limited amount of Luo, the local tribal language, that I learned, I would smile, wave, and reply, "Ichiomabehr! Arrow commano (Great! Thank you!)!" Within one day of my arrival in Mbita, I learned a very important lesson for survival: in order to reach your destination on your time, you must set out at least thirty minutes early, excluding travel time. Whether you walk five miles or venture out for a mere five minutes, you will always find at least one person who will stop, greet you with a handshake, and begin a conversation. Being a stranger wouldn't even impede this jovial ritual.

The naturally outgoing and welcoming spirit embodied throughout Suba District was an extremely impressive facade for the destitution that almost all of the villagers experienced. During one of our many escapades to the villages, Matilda pointed out to me, "Megan, look around. Every single person you will meet here is a farmer. They hold other occupations as well, but in order to survive, they must still grow their own food. Sometimes even that is not enough to sustain the family." I had known that Kenya was a poverty-stricken nation plagued with many diseases, but being thrown into the midst of it all gave me an eye-opening shock. It is said that the only thing to fear is but fear itself. I have now found an even more frightening vision. The living conditions that I descried gave me nightmares. But sometimes fear is beneficial. The horrid scenes that were laid out before me day after day provided me with a new perspective on life. Before witnessing the living situations of these farmers, I had always tried to not take things for granted. However, now, even watching someone throwing away a cracked and chipped

glass makes me cringe. Although some of my friends in Kenya who found themselves in these impoverished situations couldn't afford much, they were able to bestow me with the most valuable presents that I have ever received. They gave me their trust and provided me with motivation to want to help. I know that if I ever found myself in peril, they would do anything they could to aid me. Now I want to aid them in their plight.

On one of my first days interviewing farmers, I found myself in a village where the main problem was the lack of water. There wasn't any water to drink, to quench the thirst of the crops, or even to wash the children's hands. One particular farm in this village sticks out in my mind. There was a little boy named Nick who was probably not more than four years. During my entire visit with his parents his larger, brown eyes never moved off of me. As the interview progressed, he slowly crept closer and closer to my seat. By the time I had completed talking with his parents, he was sitting on my lap with a broad smile across his face. After the interview, Nick excitedly led me to his two shy sisters. None of them knew English, but I was able to understand enough from just gazing at them. As the three children attempted to communicate with me, I noticed the skimpy and filthy clothing they wore. Nick's shirt was nothing but holes with cloth in between. I could tell that it had once been white, but now it was caked with dirt. It hadn't been washed for at least a few weeks. His sisters' clothes were in the same, unbearable condition, but yet they chattered away happily in Luo. As I descried the entire family and their farm I thought of the water fountains sporadically scattered throughout my school. I thought of the huge swimming pools overflowing with water in the United States. I remembered the bottled water I could buy from vending machines, restaurants, grocery stores, or even gas stations almost anywhere I would go. I had always just pictured this vital liquid as being overabundant. Viewing Nick and his family made me realize just how wrong my assumptions had been.

During my two-month adventure, I made many memories and friends. Although I had left my mother, father, and brother behind in America, I had another set of parents and brothers and sisters waiting for me in Mbita. The entire village became my family. I was living on my own, but I still had a mother calling my room every night to make sure I had eaten my dinner. I had a father ensuring that I ate my vegetables. I had sisters and brothers making sure that I was never lonely. I missed my family at home, but I still had a family watching out and caring for me in Kenya.

My last day in Mbita arrived long before I was ready to leave. I had planned on spending the day saying good-byes and packing, but Matilda had another surprise for me. We loaded ourselves into a car and drove for two hours over the rough terrain. The vehicle came to a stop in the middle of nowhere. There we descended and continued on foot for yet another hour. We traversed through fields of wild grasses that went far above my five foot, seven inch frame. Eventually, Matilda came to a halt in the middle of the most pathetic field of crops I had seen since I had arrived in Kenya. She pointed straight ahead of her and that's when I noticed a small, dilapidated shack. I told myself that there was no way that it could possibly be inhabited. In Kenya, however, most of my assumptions had been disproved. This just added to the count. As we entered the one-room hut that was half the size of my bedroom, I was revolted to discover a mother and

her child sitting in a corner. A young girl followed us into the room. She went to a pail holding mud-black water with dead mosquitoes skimming the top in which she washed her hands. I learned that the mother, Docila, and her young child, Rachelle, were positive for HIV. Rachelle's father had died from the very disease just a year earlier. As I held Rachelle I was amazed at how light she was. She could barely stand on her own and was as small as a one-year-old baby. I was appalled to find out that she was actually almost five years old. According to Matilda, it was a miracle that Docila was even alive today. She had no support, and alone she farmed the field we had crossed to provide food for her household. The other little girl that had followed us into the room was Docila's orphaned niece whom she provided for as well. As we left that afternoon, I realized that I had found the true definition of strength for my dictionary: Docila.

I spent that final night in Mbita revisiting all of my favorite spots. I enjoyed one last picnic dinner at the cove that evening. As the sunset and Magic Town began to reappear in the distance, I thought of how much I had changed since my first night in Mbita. My perspectives on life had been drastically altered. I finally comprehended Cather's explanation of finding true friends amidst solitude. My ambitions and goals for the future were re-set. I now looked towards a time when I would be able to help Diana, Irene, Nick, Rachelle, Lawrence, and all of my Kenyan friends. I was no longer Megan Srinivas, citizen of Fort Dodge, Iowa. I was now Akyni Mzungu, citizen of the world. I thought of the numerous secrets dear Lake Victoria had revealed to me. The whole region revolved around this magnificent body of water. I had learned so many things, gained numerous insights, and knew that I would always remember its impact of these two months on my life. No matter where I go, I will forever carry a piece of the region and its people in my heart. With all that Lake Victoria and its surroundings had given me, I wanted to give something back in return. For my final farewell that night, I wrote a poem of my innermost emotions. I walked from the cove to the edge of the Lake where I slipped my emotions into the tide and watched them swim freely in the rippling water. My final farewell to the lake, the region, the Luo, and my Kenyan family read:

The serenity washed on by the cove,
A love, hate, gentle, rough, tie that bonds.
Memories and experiences to never escape,
My soul heaving with the trying weight.
My heart throbbing from what I've descried,
But yet, the light shines strong.
The strength I've seen increases my own,
Embracing the new world I've observed, the new life I've lead every day.
My path's twisted by shallow waters,
Awaiting the next wave to ride up, the next sign.
Watching Magic Town fade into the morning lights.
Leaving with the deepest imprint on my soul,
And looking as the waters swallow a piece of me,
Knowing someday I'll return to the friends, the memories, the love, the cove...

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APPENDIX 1

Analysis of the Health, Educational, and Socioeconomic Aspects of Farmers in Suba District, Kenya

Name:_____ Age:_____ Gender:_____

Education:_____ Village:_____ Division: _____

Date:_____ Project Farmer/ Non-Project Farmer:_____

1. a) Are you married? _____

   b) How many wives do you have/ how many wives are there? _____

   c) How many children by each wife?
   1st: _____ 2nd: _____ 3rd: _____ 4th: _____

2. a) Up to what level of education does/do your wife/wives have?
   1st: _____ 2nd: _____ 3rd: _____ 4th: _____

   b) How much education does each of your sons have?
   1st: _____ 2nd: _____ 3rd: _____ 4th: _____
   5th: _____ 6th: _____ 7th: _____ 8th: _____
   9th: _____ 10th: _____ 11th: _____ 12th: _____

   c) How much education does each of your daughters have?
   1st: _____ 2nd: _____ 3rd: _____ 4th: _____
   5th: _____ 6th: _____ 7th: _____ 8th: _____
   9th: _____ 10th: _____ 11th: _____ 12th: _____

3. Who is the head of the household?
   Male: _____ Female: _____

4. What are the major sources of family income (occupation/s)? (rank in order)
   1st: _____
   2nd: _____
   3rd: _____
   4th: _____

5. a) Approximately, what is the total family income for one year? _____

   b) Approximately, what is the total family expenditure for one year? _____

6. a) What is the total area of land owned by the family (in acres)? _____

   b) What is the total area of land under cultivation? _____

c) Why is not all of the land being cultivated? _____
_____
_____

7. a) What are the major food crops you grow? (rank in order)
1st: _____ 2nd: _____ 3rd: _____ 4th: _____
Other/s: _____

b) List any cash crop that you grow: _____ _____ _____

c) Why do you not grow some traditional African crops? _____
_____
_____

8. a) What are your major constraints in crop production?
Weed infestations ____ Pest infestations ____ Weather ___
Lack of equipment ___ Inadequate Extension Services ____
Financial Problems ____ Labor ___ Poor Infrastructure ____
Other/s _____

b) What are your major problems in maize farming? (rank in order)
1st: _____
2nd: _____
3rd: _____
4th: _____

c) Which is the major pest problem in maize farming? _____

d) Which is the major weed problem in maize farming? _____

e) What methods do you use to solve the pest and weed problems in crop farming?
Intercropping ____ Crop rotation ____ Cow dung ____ Push-Pull ____
Weeding/Uprooting ____ Early maturing crops ____ None ____
Other/s _____

f) At what stage of the crop growth do stemborers attack?
_____

g) What is your knowledge of the lifecycle of the stemborer?
_____
_____
_____

h) At what stage/s of the crop growth does the striga weed attack?
Knee-high ____ Tasseling ____ At harvesting ____ At germination ____
Other/s _____

i) What are some symptoms after your crop has been attacked by striga?
Slow growth ____ Weak plants ____ Dry plants ____ Poor yield ____
Premature/ early flowering ____ Other/s _____

9. a) Are you aware of the "Push-Pull" strategy? Yes ____ No ____

b) If yes, then what was your source of information?
Neighbors ____ Media ____ Extension Staff ____ ICIPE ____
Field Days ____ Baraza ____ Other/s _____

c) Do you practice the "Push-Pull" strategy? Yes ____ No_____

d) If yes, then for how long? >1year ____ 1-3 years _____ 3 years+ _____

e) How have you benefited from "Push-Pull?"
_____ _____
_____ _____
_____ _____

f) If not practicing, are you interested in adopting the technology, and why?
_____
_____

10. On average, how many hours a day does each family member work on the farm?
Men _____ Women _____ Children _____

11. a) Do you own any livestock? Yes ____ No____

b) Indicate type and number:

TYPE	NUMBER
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

c) Do you get milk from the cattle? Yes ____ No____

d) If yes, how do you utilize this milk?
Consume _____ Sell _____ Consume and Sell Surplus _____

e) What is your annual income from milk sales? _____

f) If cattle do not provide milk, do you buy it? Yes ____ No ____

g) If yes, what is your annual expenditure? _____

12. a) What are the major constraints to livestock production in the area?
Diseases ____ Tsetse (insects) ____ Drought ____ Wildlife ____
Lack of knowledge ____ Lack of feed/stockiest ____
Shortage of drugs ____ Other/s _____

b) How do you control ticks? _____
_____

c) How do you control tsetse fly? _____
_____

d) Do you use the ICIPE-Nguu trap for the tsetse fly? Yes ____ No ____

e) If yes, do you find it effective in controlling the tsetse fly? Yes ____ No ____

f) If you don't use the trap, give the reasons why: _____
_____

g) If the traps are freely distributed, would you utilize it? Yes ____ No ____

h) If tsetse traps are easily available, would you buy it? Yes ____ No ____

i) If you had the opportunity to learn how to make the trap yourself, would be interested to learn? Yes ____ No ____

j) To what intensity has the tsetse fly affected your farming activities?
Very Low ____ Low ____ Moderate ____ Serious ____ Very Serious ___

k) If the tsetse is not controlled, what impact do you believe it will have in Lambwe on farming in the future?
Very Low ____ Low ____ Moderate ____ Serious ____ Very Serious ___

13. a) What are the major human health problems in Lambwe?
_____ _____
_____ _____
_____ _____

b) From your understanding, what causes malaria?

_____
_____

c) What is your knowledge of the malarial parasite?

_____
_____
_____

d) What is the effect of malaria on farming?

_____
_____
_____

e) On average, how many times a year do the members of your family contract malaria? _____

f) What methods of control do you use?

_____
_____
_____

g) Do you ever attempt to use local plants to control malaria? Yes ____ No ____

h) If yes, what plants do you utilize?

_____ _____
_____ _____

i) What are other major health problems that affect farming in Lambwe in general?

_____ _____
_____ _____
_____ _____

14. a) What do you believe are the main causes of poverty in **<u>Africa</u>**?

_____ _____
_____ _____
_____ _____

b) How could the livelihoods of the people of Lambwe be improved?

_____ _____
_____ _____
_____ _____

c) What role should governments and NGOs play in reducing poverty in **Africa**?

_____ _____
_____ _____
_____ _____