
Advancing Ethiopian Small Ruminant Production Systems

Trevor Alan Clemens

*2015 Borlaug-Ruan International Intern
World Food Prize*

*International Livestock Research Institute
Addis Ababa, Ethiopia*

June-August 2015

ILRI

INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE



**THE WORLD
FOOD PRIZE**



Livestock and Irrigation Value chains for Ethiopian Smallholders

Table of Contents

Acknowledgements.....	ii
Abstract.....	iv
1. Introduction.....	1
1.1 The Country of Ethiopia.....	1
1.2 ILRI.....	2
1.3 LIVES.....	3
2. My Research.....	4
2.1 Research Objective.....	4
2.2 Research Question.....	4
2.3 Research Hypothesis	4
2.4 Methodology	5
3. Ethiopia’s Small Ruminant Results.....	7
3.1 Production and Management Systems	7
3.2 Reproduction and Breeding Practices	9
3.3 Marketing	11
3.4 Small Ruminant Health	12
4. Personal Connection Comparison.....	13
4.1 United States Literature Review	13
4.2 United States’ Small Ruminant Results: Production and Management Systems.....	14
4.3 United States’ Small Ruminant Results: Reproduction and Breeding Practices	15
4.4 United States’ Small Ruminant Results: Marketing	16
4.5 United States’ Small Ruminant Results: Health	17
5. Conclusion: Closing the Gap	18
Personal Remarks	19
Citations	22
Appendix.....	23

Acknowledgements

I would first like to express my deepest gratitude to the **World Food Prize Foundation** for providing me with such a life-changing experience and opportunity. I am also very grateful for the late **Norman Borlaug**, who used his passion to develop such an organization that currently provides young people, like myself, hands-on opportunities to make a difference in global agriculture. Thank you to **Mr. John Ruan and family, Ambassador Kenneth M. Quinn, Mrs. Lisa Fleming**, and the rest of the World Food Prize staff for everything you have done for me. Your hard-work and dedication has fueled my passion for global agriculture and has left an everlasting impact on my personal fight to solve world hunger.

Many thanks to **Dr. Azage Tegegne**, LIVES-project manager, and **Dr. Soloman Gizaw**, livestock expert, for giving me the opportunity to work at the International Livestock Research Institute on the Livestock and Irrigation Value Chains for Ethiopian Smallholders (LIVES) project. Both of you have an indescribable passion for Ethiopian agriculture and it is evident in everything you do. To the rest of the LIVES project team, thank you for making me feel like part of the team and for your continuous support involving my field work and other forms of study. A very sincere thank you also goes to my loving and caring Ethiopian mom, **Tigist Endashaw**. I always looked forward to our daily tea sessions at the Zebu Club and your constant check-in calls and or messages. Your generosity is simply overwhelming, and the faith you have in God is contagious. And to everyone else at ILRI, thank you for the continuous smiles and the thoughtful comments every day. Your friendliness, patience and assistance was very much appreciated during my two month stay in Addis Ababa.

A special thank you to all my teachers at Tri-County CSD in Thornburg, IA for their constant support. Thank you to **Mr. Trent Steinhart**, my past FFA advisor and Ag teacher, for giving me the opportunity to attend the 2014 Iowa Youth Institute and the 2014 Global Youth Institute. Thank you for encouraging me to find my own passion for agriculture and for pushing me to constantly succeed. You will forever be one of the most influential people in my life, and with great sadness, you will be missed at Tri-County. Another thank you goes to **Mr. Vincent Hrasky**, my high school English teacher, for all of the life lessons and encouragement he has provided me with thus far. I will never be able to repay you for your continuous support throughout my high school career along with the wise words you have always provided me with, no matter what the circumstances were. I'd also like to thank **Mrs. Shelly Koehn**, my high school Secretary, for her patience when proofreading my WFP papers and internship applications, along with many other high school papers and documents. You will forever hold a special place in my heart for the continuous support and knowledge you have instilled in me.

Thank you to **Ron and Chris Grier**, also known as my goat parents, for being my ultimate drive behind this project, and for adopting me as their "goat son". Your passion for the goat industry and the youth has driven me to make this industry an ultimate part of my future.

I would like to thank my **Heavenly Father** for simply blessing me with much more than I deserve. Thank you for constantly watching over me and guiding me to find my own light in today's world.

You have been and will always be my safe-house. I would also like to express my deepest gratitude to my church family of the What Cheer United Methodist Church for their constant support and prayers. And to everyone else in my community that believed in me, thank you.

Lastly, from the depth of my heart I would like to thank my family and friends. Thank you to the man that has taught me to work with my head rather than my hands, and the single and utmost influential businessman in my life, **Uncle Buddy (Eric Coble)**. Thank you to my **Aunt Teresa Valenta** for believing in me and for instilling your passion to travel the world within me. Thank you to my five crazy sisters: **Megan Martin, Mandy Jo Clemens, Kylie Davis, Hanna Acord, and Jenna Acord**. Thank you for always looking up to me, even if I was the younger one. Your loving and crazy attitudes add character to our family. Thank you to my best friend, **Maddie Fenton**, who has constantly believed in me and driven me to success with the love she has provided me with. Last but not least, to all four of my parents: **Tim Clemens, Heather Clemens, Lisa Icenbice** and **Joe Icenbice** for being my constant support group and my biggest inspiration. I dedicate this paper to each and every one of you.

Abstract

Title: LIVES: The Ultimate Ethiopian Intervention

Name: Trevor Alan Clemens

Institute: The World Food Prize Foundation, Des Moines, IA, USA

Supervisor: Dr. Azage Tegegne; Dr. Soloman Gizaw

“My grandfather used to say that once in your life you need a doctor, a lawyer, a policeman and a preacher but every day, three times a day, you need a farmer.”

- Brenda Schoepp

Ethiopia’s inability to feed its population triggers a broad economic and sociological debate. With that being said, the problem of Ethiopian agriculture does not involve poor soils, bad climate conditions and non-abundant water resources. The problem lies more in the fact that Ethiopian farmers are continually practicing essentially the same farming methods with very little technical or management improvement for what has been a very long period of time.

The above quote was the foundation for my research at ILRI while working on and assisting the LIVES project team. My specific project focused on studying small ruminant production systems in two selected intervention areas in the LIVES project in South Wollo and West Shoa. My study included:

- Understanding the production environment and production systems in the 2 zones
- Assess productivity and reproductive performance of sheep and goats
- Assess sheep and goat production challenges: diseases, feeding and marketing

Being a small ruminant farmer myself, many scientist and livestock experts on the LIVES project team asked me to provide them with information from the United States. It was then I decided to study the same information for United States small ruminant production systems and provide the comparison results to the LIVES project team, hoping they can implement new technologies and methods in the near future.

The LIVES project will not be completed until March 2018, but the already collected data and quantitative analysis of the questionnaires and focus group discussions suggest that the project will be beneficial to the economic well-being of the Ethiopian smallholder farmers, but only if the farmers continue to allow LIVES interventions to take place. These interventions will allow smallholder farmers within their given regions to take the next step in advancing Ethiopian agriculture.

1. Introduction

1.1 The Country of Ethiopia

Ethiopia is Africa's oldest independent country and is the second largest in terms of population. Ethiopia is a very unique country because it has never been colonized and is known for its cultural heritage. It is the home of the Ethiopian Orthodox Church, one of the oldest churches known to man-kind. The country of Ethiopia covers approximately 1,221,900 square kilometers and is divided into nine different regions. The country shares borders with Sudan, Kenya, Somalia and Djibouti. The major physiographic features of Ethiopia include a massive highland covered with mountains and plateaus divided by the Great Rift Valley and surrounded by lowlands along the periphery. Therefore, with the diversity of Ethiopian terrain, the country varies in fundamental climates, settlement patterns, soil composition and natural vegetation.

According to the World Fact Book, Ethiopia had a staggering population and economic growth from 2013 to 2014 by 10.3%. With that being said, the total population of Ethiopia was recorded at 96,633,458 people in July 2014.

Chart 1.1 ~ Region Size and Population

Region Name	Population	Area (km²)
Afar Region	1,411,092	72,052.78
Amhara region	17,214,056	154,708.96
Benishangul-Gumuz Region	670,847	50,698.68
Gambela Region	306,916	29,782.82
Harari Region	183,344	333.94
Oromia Region	27,158,471	284,537.84
Somali Region	4,439,147	279,252
Southern Nations, Nationalities, and Peoples' Region	15,042,531	105,887.18
Tigray Region	4,316,988	41,409.95

Overall, agriculture is the foundation for the Ethiopian economy, accounting for half of gross domestic product, 83.9% of exports, and 80% of total employment. The country's major cash crop is coffee, but the country is also known for its agricultural production and exports of flowers, khat, cotton, sorghum, millet and corn. Though, the consumption of fruits and vegetables are very limited because of their high cost, common fruits and vegetables include: cabbage, peppers, onions, bananas, and most citrus fruits. The livestock sector also plays an important role in Ethiopia's economy. Although livestock production varies from region to region, almost the entire rural population is involved in some type of animal husbandry with livestock roles involving food, transportation, fuel, cash and draft power.

All in all, Ethiopia has great agricultural potential due to its diverse climate, vast areas of fertile land, adequate rainfall and large workforce. However, because of occasional droughts, weak infrastructure, low level of technology, overpopulation, and most importantly, lack of knowledge, Ethiopian agriculture remains undeveloped. This is where governmental projects come into play, including the project I took part in during my research time in Addis; LIVES.

1.2 ILRI



The International Livestock Research Institute (ILRI) is a non-profit-making and non-governmental organization with headquarters in Nairobi, Kenya, and a second principal campus in Addis Ababa, Ethiopia. The ILRI mission is “To improve food and nutritional security and to reduce poverty in developing countries through research for efficient, safe and sustainable use of livestock – ensuring better lives through livestock.” ILRI envisions a world where all people have access to enough food and livelihood options to fulfill their potential. (ILRI, 2015)

ILRI’s strategic intention is to use livestock as a development tool that widens and sustains three major pathways out of poverty:

1. Securing the assets of the poor.
2. Improving smallholder and pastoral productivity.
3. Increasing market participation by the poor.

1.3 LIVES

The Livestock and Irrigation Value Chain for Ethiopian Smallholders (LIVES) project began in April 2012 and is led by the International Livestock Research Institute (ILRI) and the International Water Management Institute (IWMI). This project is funded by the Department of Foreign Affairs Trade and Development (DFATD) of Canada to promote market-led agricultural development. Since the very beginning, the LIVES project has been scaling out successful approaches and intervention for key high-value livestock and irrigated crop commodities. The project is due to end in March 2018.

The goal of the LIVES project is to contribute to enhanced income and gender equitable wealth creation for smallholders and other value chain actors through increased and sustained market off-take of high value livestock and irrigated crop commodities. The project aims to improve the effectiveness of the research and extension system to support market-oriented commodity development by:

- Promoting the use of participatory, market driven, gender sensitive and sustainable development approaches;
- Promoting the involvement of value chain actors and suppliers of inputs and services in the development process;
- Promoting improved knowledge management approaches for capturing, storing and sharing knowledge;
- Supporting village and district level development of community, cooperative, farmer and private sector production and supply of inputs and provision of services;
- Promoting linkages/dealership networks with value chain actors and service providers at regional and federal levels;
- Promoting diagnostic, action, impact studies on value chain interventions. Documentation of results and lessons learned will be used for learning within the project areas and to scale out beyond the project areas. (LIVES, 2015)

LIVES works with public and private sector partners to develop livestock (dairy, small and large ruminant, poultry and apiculture) and irrigation (fruits, vegetables and fodder) value chains in 10 zones of four Ethiopian regions; Amhara, Oromia, SNNP and Tigray.

The LIVES project carries out activities in five focus areas:

1. *Capacity Development*
2. *Knowledge Management*
3. *Promotion*
4. *Value Chain Development*
5. *Documentation*

Region	Zone	Dairy	Beef	Small ruminant	Poultry	Honey	Irrigated crops
Tigray	Eastern Tigray	X		X		X	X
	Central Tigray	X		X	X		X
Amhara	West Gojam	X	X		X		X
	North Gondar	X	X		X		X
	South Wello	X		X		X	X
Oromia	East Shoa	X	X		X		X
	West Shoa	X		X		X	X
	Jimma			X	X	X	X
SNNP	Gamo Gofa		X	X	X		X
	Sidama	X		X	X		X

2. My Research

2.1 Research Objective

The objective of my research was to study small ruminant production systems in two selected intervention areas of the LIVES project in South Wollo and West Shoa through a questionnaire made by myself. My study included:

- Understanding the production environment and production systems in the 2 zones
- Assess productivity and reproductive performance of sheep and goats
- Assess sheep and goat production challenges: diseases, feeding and marketing

After Ethiopian data was collected, my next objective was to use the same questionnaire to study small ruminant production systems within the United States and to compare the results given for each country. This was set up to provide the LIVES project team with information on new technologies and methods being used in a different country so they could potentially implement new technologies and methods within their project sites.

2.2 Research Question

Based on my research objectives, a research question was formed. **“Will the LIVES project benefit from a comparison study between small ruminant production systems in Ethiopia and the United States?”**

2.3 Research Hypothesis

After my research question was presented, a research hypothesis was formed. **“The LIVES project will benefit from a comparison study between small ruminant production systems in Ethiopia and the United States due to the introduction of new technologies and farming methods. In conclusion, this will allow the LIVES project team to be more beneficial to the economic well-being of Ethiopian smallholder farmers.”**

2.4 Methodology

Image 2.1 ~ Questioning Farmers in the South Wollo Zone



After assigned my research project, I made one questionnaire for two sets of farmers; South Wollo farmers and West Shoa farmers. At this point in my internship, I was unaware that I would have the opportunity to discuss with other sector farmers, therefore my questionnaire was based strictly on the production practices of small ruminant smallholder farmers.

The first part of my questioning took place in the South Wollo zone, where I stayed 10 days for field work. Farmers that had undergone LIVES interventions were randomly selected and interviewed. There were a total of 14 farmers interviewed in the South Wollo zone; 7 sheep farmers and 7 goat farmers. All questions and responses were asked and translated by the LIVES project manager of the South Wollo zone. After questioning the farmers, I was then taken to the animals themselves to study their physical characteristics. My questioning only took two full days, while the other eight days were spent visiting other farms that had or were undergoing LIVES' interventions. Visiting other farms allowed me to gain the hands-on experience within each LIVES sector.

I then returned to ILRI and logged my questionnaire responses and discussions into Microsoft Word. After spending two weeks in Addis Ababa, working on my collected data, traveling the city, and learning about Ethiopian culture and heritage, I left to visit the West Shoa zone for five days to complete the second part of my questioning.

My visit to West Shoa consisted of the same exact questionnaire asked to 14 small ruminant farmers and translated by the LIVES project manager within that zone. After the questioning was done and animal characteristics were noted, I had the opportunity to visit more LIVES intervention sites and one of Ethiopia's largest livestock markets in Ginchi Town.

After completing both of my field studies, I analyzed the responses given for each question to look for any similar and widespread trends. Then I cross analyzed the responses given on questions that depicted the differences in opinions.

After I finished noting all of Ethiopia's small ruminant results, I then used the same questionnaire to find out more information about small ruminant production systems within the United States. Though I am very familiar with them myself, talking to farmers was very necessary. Exactly 28 small ruminant farms were asked questions by myself via email and phone calls. Again, I analyzed the responses given for each question to look for any similarities or differences. After I had the data from all 56 questionnaires, 28 Ethiopian and 28 United States, I compared the production systems, reproductive practices, marketing and small ruminant health between the two countries. Though this was not a requirement of my study, it was something that provided the LIVES project team with information on new technologies and farming methods being used in other countries. Emails and other contact personal were exchanged and I am now communicating with various, experts across Ethiopia about the uses of technology on my farm and how they can implement them on their project sites.

Image(s) 2.2 ~ Visiting a coffee plantation that is currently working with the LIVES project.



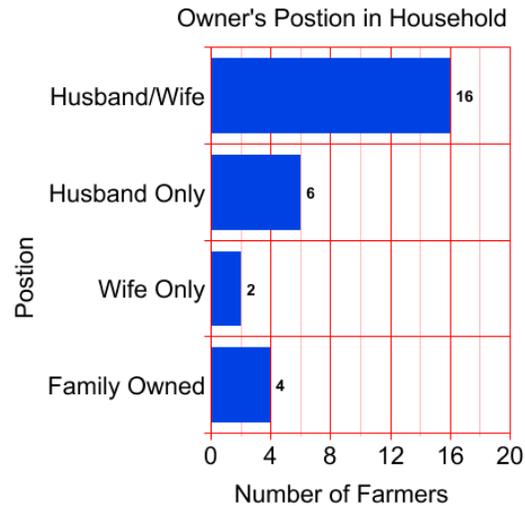
Image(s) 2.3 ~ Collecting small ruminant data in the South Wollo zone.



3. Ethiopia's Small Ruminant Results

3.1 Production and Management Systems

Chart 3.1



The graph above shows the owner's position in the household. Of the 28 farmers questioned, including both sheep and goats, over half of the herds were jointly owned by both husband and wife. It seemed that the more religious households were owned strictly by males and about 14% were family owned. This practice often took place when the father of the household gave each of his children, particularly male children, one breeding female to start generating an income for that child. Only 2 of the questioned farmers were strictly female or wife owned, both of which were widowed women.

Based on my questionnaire, the most common trend between the two species, sheep and goats, and the two zones, South Wollo and West Shoa, included the overall purpose of keeping small ruminants. With that being said, 100% of goat breeders in South Wollo and West Shoa ranked income as their number one purpose. This is very similar to the sheep breeders within the two zones, where 100% of South Wollo breeders also chose income as their number one purpose and 71% of West Shoa breeders chose income as well. The other 29% of West Shoa sheep breeders ranked savings as their number one purpose of keeping sheep. Other common responses for the purpose of keeping small ruminants include: wealth status, meat for home consumption and the animal hide/skin.

Within the South Wollo zone, 71% of interviewed goat farmers answered yes to expanding their flock in the future to generate more income, while the other 29% answered no due to the lack of grazing land and overall feed shortages. Of the sheep breeders within the same zone, 86% answered yes and 14% answered no due to the exact same reasons. The answers and percentages were exactly the same within the West Shoa zone for both sheep and goat breeders. Also, 100% of small ruminant farmers within the two zones noted that housing was available for their flocks.

All 28 small ruminant farmers within both zones noted that natural pastures were their flocks' main food source, being freely available each day in both the dry and wet seasons. Hay ranked second as a main feed source, followed by homemade concentrates and crop residues. Only 1 farmer noted that he fed his flock improved forages. Because Ethiopia has dry and wet seasons, water availability and frequency of watering animals vary greatly between the two zones. Answers to all water questions have been graphed below.

Chart 3.2
South Wollo Flocks' Main Water Source

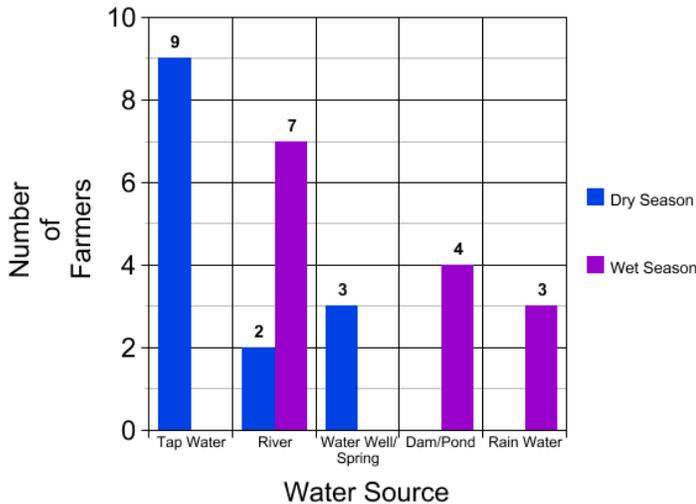


Chart 3.3
West Shoa Flocks' Main Water Source

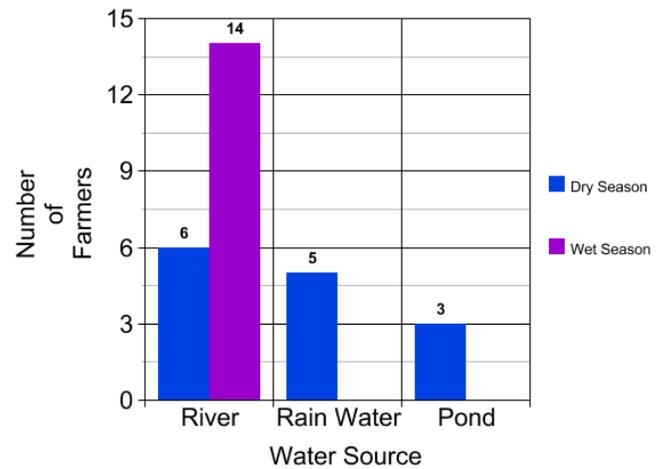


Chart 3.4
South Wollo Frequency of Watering Flock

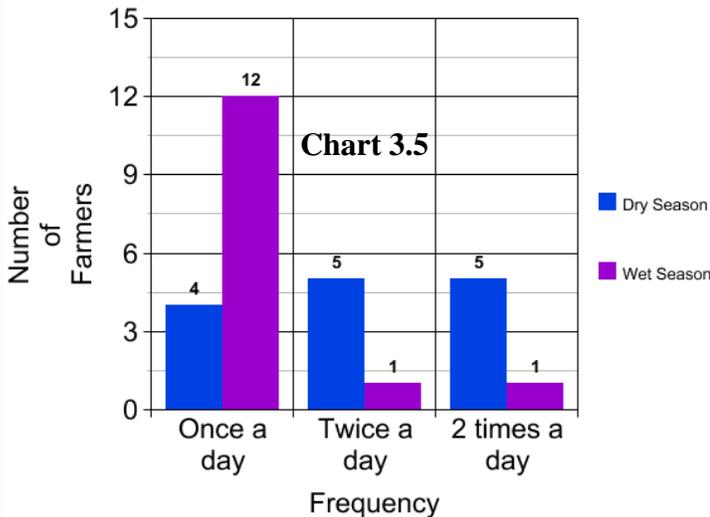
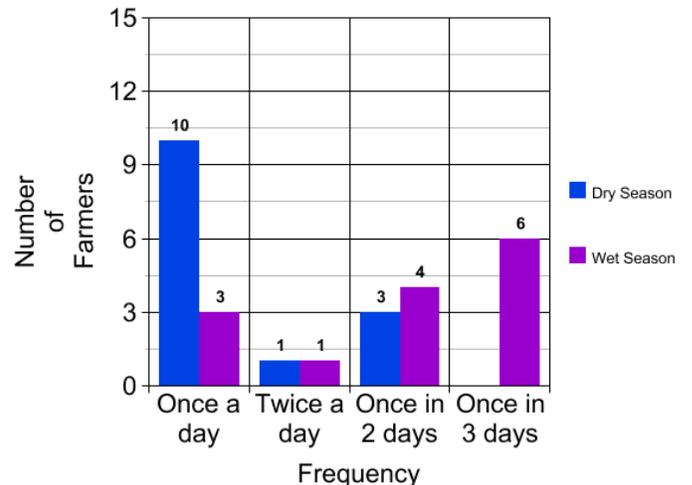


Chart 3.5
West Shoa Frequency of Watering Flock



3.2 Reproduction and Breeding Practices

A smallholder farmer's herd size often represents the wealth status of that particular farmer or family. The herd size depends on many factors including: grazing land available for the flock, whether or not the income of the family is enough to support the number of animals within the flock, food scarcities and the farmer's knowledge about their species and flock. Within the South Wollo zone, farmers own on average four breeding females and about 70% of one breeding male. This means community breeding systems are in place allowing farmers without breeding males to breed their females by using other intact males within the community, including other family members' or local neighbors'. This is similar to the West Shoa zone, where a farmer, on average, owns 6 breeding females and 2 breeding males. However, there were two sheep breeders that owned about 20 breeding ewes each, and one goat breeder that owned about 40 breeding does. Though it is very rare for a farmer to own this many animals, it was obvious these farmers were very knowledgeable and innovative. Between the two zones, only one farmer had cross-bred animals.

The breeding and mating systems between the two zones were very similar. About 50% of the farmers having a controlled breeding system while the other 50% were uncontrolled. The main reasons for uncontrolled systems include: herd grazed together, lack of awareness, and an insufficient number of intact breeding males. However, farmers informed me that this has not always been the case. In fact, it was not until six months ago that farmers began changing their breeding systems from uncontrolled to controlled, due to recent LIVES interventions. Though the LIVES project team has not held interventions within each community, they have plans to in the future. This will result in almost 100% of LIVES' farmers using controlled breeding systems. There was also one breeding community that used hormone synchronization provided by the LIVES project to better control the breeding systems within that community.

The selection criteria for breeding males remained the same between the two zones, but the breeding female criteria showed quite a bit of difference. The results for selection criteria for all breeding animals are show below.

Chart 3.5 ~ South Wollo Selection Criteria for Breeding Males

<i>Selection criteria in order based on ranking-</i>
Appearance/Conformation (1 st)
Growth (2 nd)
Color (3 rd)
Libido (4 th)

Chart 3.6 ~ South Wollo Selection Criteria for Breeding Females

<i>Selection criteria in order based on ranking-</i>
Milk Yield (1 st)
Appearance/Conformation (2 nd)
Kid Growth (3 rd)
Twinning Ability (4 th)

Chart 3.7 ~ West Shoa Selection Criteria for Breeding Males

<i>Selection criteria in order based on ranking-</i>
Appearance/Conformation (1 st)
Growth (2 nd)
Color (3 rd)

Chart 3.7 ~ West Shoa Selection Criteria for Breeding Females

<i>Selection criteria in order based on ranking-</i>
Twinning Ability (1 st)
Appearance/Conformation (2 nd)
Kid Survival (3 rd)
Kid Growth (4 th)

Though the average female goat and sheep will enter their first estrus as young as five months old, it is not recommended that breeding takes place at this age due to undeveloped female reproductive organs. Therefore, ideal age to breed a virgin female is around 12-16 months old. However, due to the lack of knowledge and uncontrolled mating systems, Ethiopian farmers do not wait to breed their females at the recommended ages. This often results in single births. Collected ages are shown below.

Chart 3.8

South Wollo Females' First Breeding Age

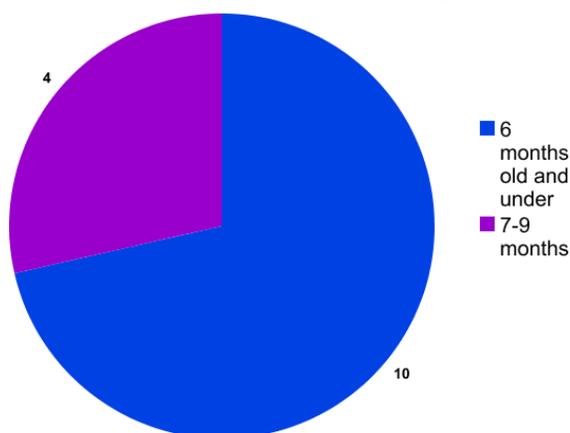
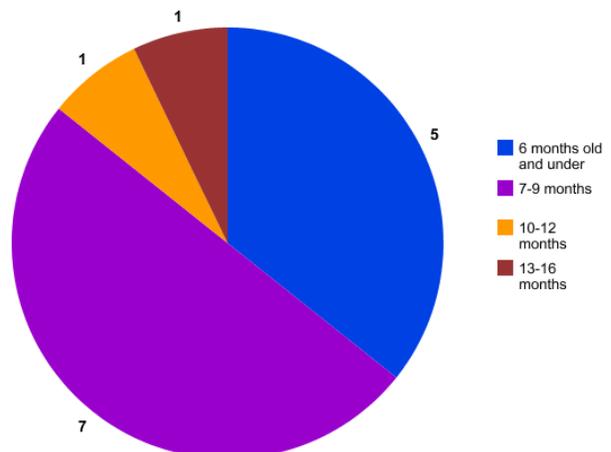


Chart 3.9

West Shoa Females' First Breeding Age



When farmers were asked about the reproductive lifetime of their breeding females, many were uncertain. The farmers told me that the reason behind their uncertainty was because they usually send their breeding females to market when she turns about six years old. Therefore, the farmers were unaware of the exact age at which their females quite reproducing. There were however many farmers that said they still had breeding females in their herds that were going on 10 years old.

3.3 Marketing

Marketing livestock is the most important process in terms of raising small ruminants in Ethiopia. This process serves as a ‘pay-day’ for the farmers and is done any-time. Of the 14 farmers interviewed in West Shoa, it takes about 71% of the farmers 45 minutes on foot to reach the nearest market, 14.5% in 30 minutes and the other 14.5% in 60 minutes. As for the 14 interviewed West Shoa farmers, it takes 50% of them to reach the market in 20 minutes, 21% to reach it in 30 minutes, 14.5% to reach it in 35 minutes, leaving another 14.5% to reach it in 15 minutes. The number one reason for marketing livestock is for immediate cash, followed by children and schooling and family health care and clothing.

Towards the end of my last field visit, I had the opportunity to visit the Ginchi Town Market. This market is one of Ethiopia’s largest livestock market. While visiting, I had the chance to see how the market works and how farmers market their livestock, specifically small ruminants. This allowed me to discuss with farmers the market prices of their livestock. After asking 10 separate farmers that were selling sheep or goats, I was able to find out the average market price; 2,600 birr which is equivalent to about \$130.00.

Image(s) 3.1 ~ Ginchi Town Market



3.4 Small Ruminant Health

Discussing and asking questions pertaining to small ruminant health presented many challenges due to the farmers' lack of knowledge. 100% of the interviewed farmers receive animal health care through a government veterinarian. However, the farmers were unaware of what kind of preventative medical procedures were given to their herds. All farmers knew the government provided their herds with deworming medications and a vaccination for pasteurellosis, but they were not familiar with other vaccinations or medications given. Contacting the government veterinarians to find out extra information was too difficult to arrange.

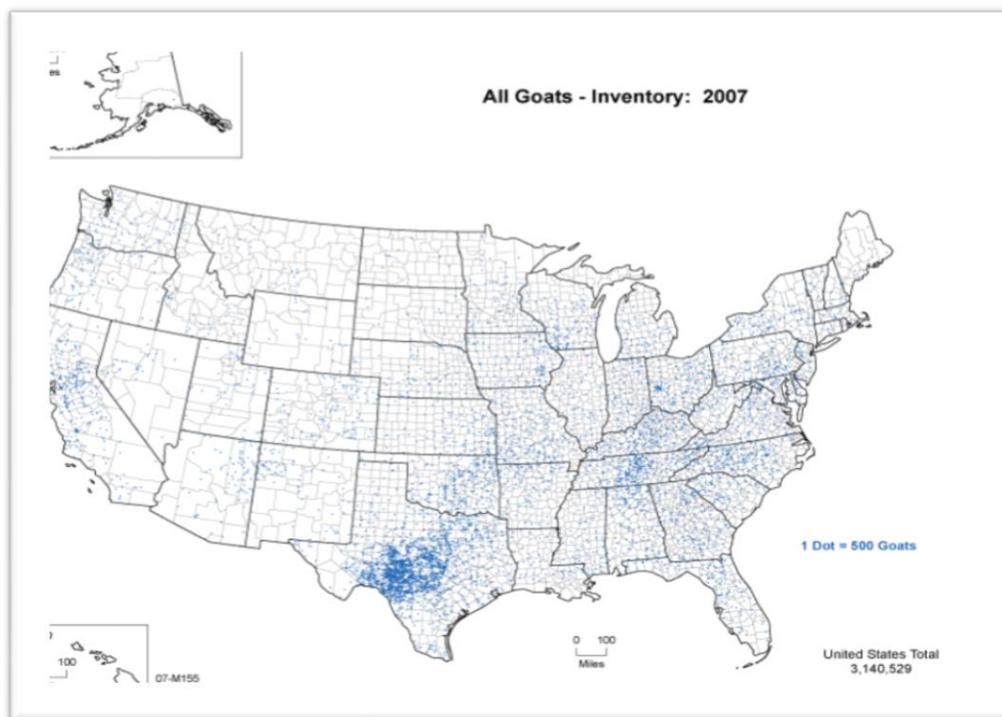
4. Personal Connection Comparison

4.1 United States Literature Review

While in Ethiopia, the most interesting part of my research involved seeing the differences between goat production farms and being able to compare them to my own goat farm. While this was not only an eye opening experience for myself, the information that I shared with LIVES' scientists and small ruminant farmers made it an eye opening experience for them as well.

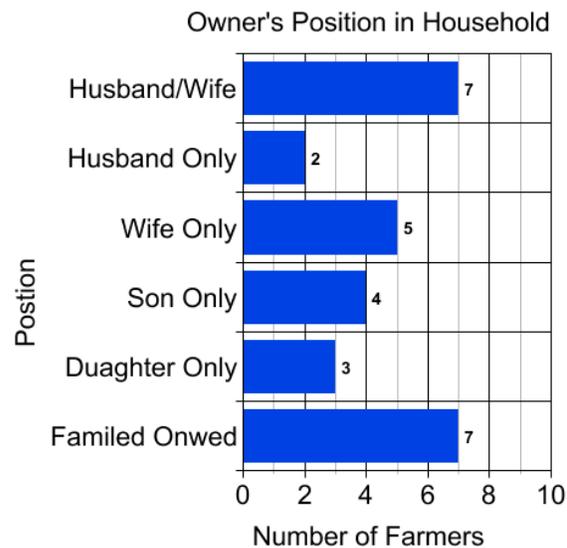
In the United States, about 42.4% of small scale goat operations are focused primarily on meat production. However, goats are raised for a variety of other uses including: milk, fiber, brush control, livestock shows, packing and lively companions (USDA, 2015).

Chart 4.1 is the US goat inventory in the year of 2007. Every blue dot equals 500 goats.



4.2 United States' Small Ruminant Results: Production and Management Systems

Chart 4.2



The graph above shows the owner's position in household within the US. The reason for this being so spread out involves the purpose of raising livestock. Based on the answers given from my questionnaire, 50% of the small ruminant farmers within the US keep sheep or goats for hobby purposes. For example, the results show that the more son, daughter or family oriented owners chose hobby as their main purpose. This is often the result of youth and family oriented organizations like the 4-H and FFA, which allow you to exhibit your animals in livestock shows. However, such practices and events can be costly. Out of the other purposes for keeping small ruminants, 36% keep them for income and 14% keep them for savings. Meat for home consumption ranked number four on the list.

Nearly 79% of American small ruminant farmers also said no to the expansions of their flocks. Many reasons were given, but the common reasons involved lack of time and the fact that most herds were already at capacity. The other 21% said yes to the expansion of their flocks for reasons like genetic improvement and income generation.

About 70% of farmers ranked natural pastures as their herd's number one feed source, while the other 30% ranked hay as their number one feed source. The second ranking feed source was homemade concentrates. This is often used during the winter months in certain climates or for other purposes like fattening for market or livestock exhibitions. The frequency of feeding animals was split in half with 50% of the farmers feeding their livestock once a day and the other 50% feeding their livestock twice a day. Nearly 100% of farmers noted that water was freely available for their flocks and was often provided by wells or tap/rural water companies.

4.3 United States' Small Ruminant Results: Reproduction and Breeding Practices

In the United States, the size of your herd often represents the purpose of keeping livestock. Based on my questionnaire, herds that were kept for income purposes were very large herds ranging from 100-200 breeding animals while herds kept for hobby purposes were moderate size herds ranging from 35-60 breeding animals. The percentages from the questionnaires proved that the typical American small ruminant farmer owns about 50 breeding females and 3 intact breeding males. However, these numbers change drastically as you move across the country with most of the large scale herds residing in the south. This part of the country is very suitable for small ruminates, consisting of a dryer climate where the animals can obtain a desirable amount of roughage from grazing. Also making this climate suitable for their digestive system. The various ethnic groups in this part of the country also make it a suitable place for raising and producing small ruminants for meat consumption.

100% of the 28 US farmers manage a controlled mating system, where they choose to breed their females at different times for many purposes like holiday markets, breeding sales and livestock shows. Nearly 60% of the questioned farmers stated that they have used hormone synchronization within their herds, often times to group kidding or lambing seasons together or to prepare for artificial breeding methods.

The different breeding methods within the US present a very touchy topic. While many breeders support the modern technological practices of artificial insemination or embryo transfers, many breeders believe the reproduction of livestock should be a natural process. These artificial practices are practically unheard of within the country of Ethiopia, aside from a small portion taking place the dairy sector. However, most American farmers have strived for these new technological advancements within reproduction, taking the genetic potential of their individual herds to an all-time high. Therefore, nearly 60% of the interviewed farmers stated they perform other breeding methods such as vaginal artificial insemination, laparoscopic artificial insemination and embryo transfers. All 100% of the 60% stated they prefer these advanced breeding methods to help improve overall herd genetics and to introduce new genetics within their herds.

Based on the answers given to the reproduction section of the questionnaire, most would believe that these technological advancements in animal reproduction are very simple to obtain due to the number of farmers that are practicing them. However, this is not the case. Putting this into perspective is very difficult when one is unaware of the processes involved in these new practices. Therefore, the best way to explain it involves the dollar sign. For example, the average quality sheep or goat semen from some of the best males in the country range in price from \$100 to \$300 per straw. When artificial inseminating a female, it is recommended a person use at least two straws, costing the farmer typically \$200 for one breeding, all of which does not guarantee that the female will become pregnant. An embryo transfer costs the average American farmer about \$2,000 to perform due to the medical procedures and the intensive hormone drugs used during the process. Though these new advancements in the American livestock sector are very costly, these procedures

could be the number one answer in advancing livestock industries around the world including the Ethiopian livestock sector.

In the US, the selection criteria is typically based on the type of livestock being raised. For example, farmers raising dairy goats would select milk yield as their number one female criteria and dairy character as their number one male criteria. However, 100% of the interviewed farmers from the US raise small ruminants for meat purposes. The selection criteria for the all breeding animals are shown below.

Chart 4.3 ~ Selection Criteria for Breeding Males (Sheep & Goats)

<i>Selection criteria in order based on ranking-</i>
Appearance/Conformation (1 st)
Growth (2 nd)
Libido (3 rd)
Character/Docile (4 th)

Chart 4.4 ~ Selection Criteria for Breeding Females (Sheep & Goats)

<i>Selection criteria in order based on ranking-</i>
Appearance/Conformation (1 st)
Kid Survival (2 nd)
Milk Yield (3 rd)
Kid Growth (4 th)

In terms of the average reproductive lifetime of breeding females, 100% of interviewed farmers stated seven to eight years in age was ideal. This is very similar to the results given from Ethiopia. However, the age at which farmer's first breed a virgin female in the US was very different. About 93% of the US goat farmers interviewed said they breed their females for the first time between 13 and 16 months while the other 7% said they breed their females between 17 and 24 months. Results from US sheep breeders show 100% of farmers breeding their females for the first time between 10 and 12 months. Allowing females to reach sexual maturity is very crucial to an American small ruminant farmer. Therefore, twinning ability was not ranked in the selection criteria for breeding females because this is typically not an issue in the US. In fact, many farmers answered triplets to the average female birth size.

4.4 United States' Small Ruminant Results: Marketing

The livestock marketing process is also very important in the US. 89% of interviewed farmers answered disposing/culling as their number one reason for marketing livestock, while the other 11% answered immediate cash and downsizing herd. According to the Texas Weekly Sheep and Goat Summary, the average market price for sheep was \$1.60 per pound and \$2.10 per pound for goats on August 24, 2013. However, many of the questioned farmers said they sell their animals for breeding and show purposes, ranging from \$600 to \$2,000 per head depending on genetic make-up and quality. In fact, it is very common for superb quality animals to sell in the \$20,000

to \$40,000 range! All in all, depending on the quality of the animal, breeders market animals at various different prices in the US.

4.5 United States' Small Ruminant Results: Health

As you move across the US, health issues change depending on the climates. Luckily my questionnaire was answered by farmers on the east coast all the way to the west coast, way up north and way down south. This provided me with many different answers, all of which are crucial to small ruminant health in the US. Nearly 100% of interviewed farmers use private veterinarians while only a couple purchase from shop or markets. The shop and markets however, are often online only.

When reading the answers given concerning number one death causing diseases or parasites within the herd, I figured it was best to list the top three answers given due to the variation in herd size and climates. Therefore, internal parasites such as roundworms and tapeworms, coccidiosis and pneumonia were the most popular answers. To fight against such diseases and parasites, US farmers de-worm their animals very frequently. Another very common preventative medical procedure that most farmers do is vaccinate with a CD/T injection, which is a vaccine that prevents the quick and fatal consequences that can result from a clostridial infection.

5. Conclusion: Closing the Gap

When the small ruminant production systems of Ethiopia are compared to those of the United States, it is obvious to see they are very different from one another. Though the advancements in the small ruminant sector of Ethiopia seem very small from the standpoint of an American, these advancements have been crucial to the country of Ethiopia and have driven the small ruminant sector to an all-time high.

The purpose of this paper was not to brag about new technological advancements within the United States small ruminant systems, but to provide the LIVES project team with very little and basic information about these advancements to ignite a possible interest in introducing some of these methods to their project sights. Introducing things like new vaccinations, breeding methods, marketing strategies and production practices are just a few very simple steps that would potentially take the Ethiopian small ruminant sector to the next step towards overall success. Based on already collected data, the LIVES project team has been beneficial to the livelihoods of many Ethiopian smallholder farmers and has done so since the project began in 2012. Though the project is continually striving to implement new advancements within their project sites, Ethiopian production systems still lack in terms of overall success.

In conclusion, knowing whether or not this comparison study between small ruminant production systems in Ethiopia and the United States will benefit the LIVES project, allowing them to be more beneficial to the economic well-being of Ethiopian smallholder farmers cannot be determined at this exact moment. However, based on the interests shown by many LIVES scientist and experts, I see this study being beneficial in the future, closing the gap between Ethiopia's poor rural economic status and its own potential to feed its growing population.

Personal Remarks



“Give a man a fish; he’ll eat for a day. Teach a man to fish; he’ll eat for a lifetime.”

- Anne Isabella Ritchie

Having grown up on a farm in a small community in Southeast Iowa and attending a very small school with a graduating class of 18, agriculture is all I have ever known. Though my immediate family does not grow corn or soybeans like the typical rural Iowa family, livestock agriculture has always been a key component within my family. Through my supervised agriculture experience within the FFA, my job at a 1,500 farrow to finish swine operation, and my involvement on the Junior American Boer Goat Association National Board of Directors, along with many other organizations like the 4-H and County Council, agriculture has been an ultimate part of my past, and I look forward to it being the ultimate piece of my future.

As my Ag teacher approached me my sophomore year of high school with the idea of writing a paper for the World Food Prize Iowa Youth Institute, I will be the first to admit that I wasn’t all that excited. I mean, the idea behind everything seemed very interesting, but the thought of sitting down and writing a research paper on a country and factor I knew absolutely nothing about was kind of scary. However, the longer I thought about it and the more I researched various different countries and key factors, the more I began to develop a passion for global agriculture. It was then that I chose to write a research paper on the farm to market crises in Uganda. Within my paper, I discussed many solutions to close the gap between the Ugandans’ poor rural economic status and their very problematic market systems.

After attending the Iowa Youth Institute, with an even stronger passion for global agriculture, I was ecstatic to receive an email informing me that I had been chosen to attend the World Food Prize-Global Youth Institute in October. As a result of my participation in the World Food Prize-Global Youth Institute, I was extremely inspired by many experts, and peers, to take part in the fight to solve the ongoing problem of food scarcity, and from that point on, I knew that the world would be able to sustain the growing population of 9 billion people by the year of 2050. As Norman Borlaug said, "Civilization as it is known today could not have evolved, nor can it survive, without an adequate food supply." The world can provide more than enough food for each and every one of us if organizations like the World Food Prize continue to have dialogues in which experts from many different countries and disciplines collaborate and share their ideas. Here, the World Food Prize is on to something, in that the path to feeding everyone is to continually have young people involved in these dialogues, for young people are capable of learning from these experts' ideas and research while expanding on their own research in the future.

It was particularly my father's experiences in life that have inspired me to be the person I am today. Born into a poor family with an abusive step-father, and five siblings, my father did not have the life of that typical 1970s child. When he was only 17 years-old, my father's mother was killed in a tragic car accident. Bouncing from house to house with very few personal items, he finished high school and began working. He worked to care for his siblings and gave them everything he had. Now, my father is a great man of wisdom and hope. He is a man that works hard for everything he has, and yet he is always willing to lend a hand. These characteristics have been instilled in me over the years, and my desire to help others grew from one of local impact to global impact. Therefore, I knew that applying for the Borlaug-Ruan International Internship was something I had to do. I then made the application process for the internship a very tedious job due to a serious perfectionist attitude, but when I got word that I had been chosen for an interview, I realized that hard work really does pay off. However, I tried not to get my hopes up because I knew that there were hundreds of qualified students going after the same internship, with the same hopes and the same exact dreams.

Receiving my internship congratulatory letter informing me that I would be spending the summer in Addis Ababa, Ethiopia at the International Livestock Research Institute was a day that will forever hold a special place in my heart. It wasn't until I was driving through the city of Addis with an unknown driver who had a serious case of road rage, and myself, who had too much jet lag to care that it hit me; this was the opportunity of a lifetime! An opportunity that would put myself in the position to advance global agriculture and to take my stand in the fight to solve the ongoing problem of food scarcity. And lastly, an opportunity that would put me on track to fulfill a portion of the FFA creed, which I have recited so many times before; "I believe in my own ability to work efficiently and think clearly, with such knowledge and skill as I can secure, and in the ability of progressive agriculturists to serve our own and public interest in producing and marketing the product of our toil." E.M. Tiffany.

This Borlaug-Ruan International Internship will forever be a life-changing opportunity that has left me with the utmost inspiration from many. Before coming to Ethiopia I wasn't sure what to expect. We've all seen the famous cliché pictures of chronically malnourished children with large

skeletal heads clinging to their mother's dried up breasts or potbellied Ethiopians with rags hanging off of them as their only form of clothing begging for a single birr, but was that really what Ethiopia consisted of? In strong respect towards Ethiopia, the country has undergone several economic reform programs in order to achieve economic stability and renewed growth in the fight against its own poverty, and it was not until I actually encountered those cliché sights, along with many more, that I truly understood poverty within Ethiopia. It was that very point in my life that I realized God gives his hardest battles to his strongest soldiers, and simply overcoming the emotional battle with myself in Ethiopia will forever allow me to see the world in a new perspective. A perspective that does not allow me to take anything in my life for granted and lastly, a perspective that allowed me to follow a famous quote, which we've all heard many times before, of Anne Isabella Ritchie; "Give a man a fish; he'll eat for a day. Teach a man to fish; he'll eat for a lifetime."

Citations

Gebreselassle, Sameul. *Intensification of Smallholder Agriculture in Ethiopia: Options and Scenarios*. Rep. Future Agricultures Consortium, Mar. 2006. Web. June-July 2015.

"Ethiopia Country Profile - Overview - BBC News." *BBC News*. BBC Monitoring, 04 May 2015. Web. July-Aug. 2015.

"Ethiopia Economic Outlook." *African Development Bank Group*. 2015 African Development Bank Group, 2015. Web. June-July 2015.

Mengistu, Alemayehu. "Ethiopia." *Ethiopia*. Addis Ababa University, July 2003. Web. July-Aug. 2015.

Coffeen, Peggy. "Protect Sheep and Goats with CDT Vaccine." *Agri-View*. N.p., 14 Mar. 2013. Web. July 2015.

"Texas Weekly Sheep & Goat Summary." (1983): n. pag. *USDA Livestock & Grain Market News*, 24 Aug. 2013. Web. July 2015.

"Lamb Monthly Price - US Cents per Pound." *Lamb*. N.p., June 2015. Web. July 2015.

"International Livestock Research Institute." *Home*. N.p., n.d. Web. July 2015.

"About." *LIVESEthiopia*. N.p., 14 May 2012. Web. June 2015.

Appendix

Questionnaire: Small Ruminants~ Ethiopia and United States

Production and Management Systems

1. Purpose of keeping sheep/goats (rank the top 3)

	<u>Ranking</u>
<i>Meat for home consumption</i>	
<i>Milk for home consumption</i>	
<i>Wool</i>	
<i>Income</i>	
<i>Wealth Status</i>	
<i>Skin</i>	
<i>Savings</i>	
<i>Hobby</i>	

2. Owner's position in household. (check one)

<u>Position in Household</u>	<u>Check One</u>
<i>Male Head</i>	
<i>Female Head</i>	
<i>Relative</i>	
<i>Son</i>	
<i>Daughter</i>	
<i>Family Owned</i>	

3. Do you intend to expand your flock in the future? Yes _____ No _____
 If yes; reasoning _____
 If no; reasoning _____

4. Main Feed Source (rank top 3)

<u>Feed Source</u>	<u>Ranking</u>
<i>Natural Pasture</i>	
<i>Hay</i>	
<i>Homemade Concentrate</i>	
<i>Crop Residues (wheat, barley, sorghum, maize, bean, pea, lentil, chick pea)</i>	

5. Frequency of Feeding Animals

<u>Frequency</u>	<u>Dry Season / Winter</u>	<u>Wet Season / Summer</u>
<i>Freely available</i>		
<i>Twice a day</i>		
<i>Once a day</i>		
<i>Once in 2 days</i>		
<i>Once in 3 days</i>		

6. Source of Water

<u>Sources</u>	<u>Dry Season</u>	<u>Wet Season</u>
<i>Boer hole/water well</i>		
<i>Dam/Pond</i>		
<i>River</i>		
<i>Tap Water</i>		
<i>Rain Water</i>		
<i>Other (Specify)</i>		

7. Frequency of Watering

<u>Frequency</u>	<u>Dry Season</u>	<u>Wet Season</u>
<i>Freely available</i>		
<i>Twice a day</i>		
<i>Once a day</i>		
<i>Once in 2 days</i>		
<i>Once in 3 days</i>		

8. Is there housing available for your flock? Yes _____ No _____

Reproduction and Breeding Practices

1. How many kids/lambs does your average female have per birth? 1 _____ 2 _____ 3 _____ 4 _____

2. Do you have cross-bred rams/bucks? Yes _____ No _____

3. Do you have cross-bred ewes/does? Yes _____ No _____

-If yes to either of the above answers, please explain reasoning for cross-breeding?

4. Breeding/Mating System Controlled _____ Uncontrolled _____

-If uncontrolled, what is the reason?

Herd grazes together _____ Insufficient Number of Intact Breeding Males _____

Lack of awareness _____ Others (Specify) _____

5. Section Criteria for Breeding Animals (Rank according to reason.) (Rank top 4)

<i>Breeding Males</i>	<i>Rank</i>	<i>Breeding Females</i>	<i>Rank</i>
<i>Appearance/Conformation</i>		<i>Twinning ability</i>	
<i>Color</i>		<i>Kid survival</i>	
<i>Character/Docile</i>		<i>Appearance/Conformation</i>	
<i>Growth</i>		<i>Color</i>	
<i>Age</i>		<i>Character/Docile</i>	
<i>Libido</i>		<i>Kid Growth</i>	
<i>Dairy Character</i>		<i>Milk Yield</i>	
		<i>Age @ 1st Sexual Maturity</i>	
		<i>Lambing Interval</i>	

6. Do you perform any hormone synchronization on your breeding females? Yes _____ No _____
 If yes, explain reasoning _____

7. Do you perform any other forms of breeding (Example; Artificial Insemination) Yes _____ No _____
 If yes, explain reasoning _____

8. Number of Breeding Females _____

9. Number of Intact Breeding Males _____

10. At what age you typically breed your females? (Check appropriate time frame)

6 months old and under	
7-9 months of age	
10-12 months of age	
13-16 months of age	
17-24 months of age	

11. Average reproductive lifetime of female (in years) _____

Marketing

1. How far is your herd form the nearest market? (minutes) _____

2. What season do you usually sell animals?

Wet/Summer Season _____ Dry/Winter Season _____ Any time _____

3. Reasons for typically marketing animals. (Rank top 3)

<u>Reason</u>	<u>Ranking</u>
Immediate Cash	
Disposal/Culling	
Feed Shortage	
Children/Schooling/Etc.	
Family Health Care/Clothing	
Downsizing Herd	

4. Average market age. (months) Male _____ Female _____

5. Is your overall herd number increasing in the last 10 years?

Increased _____ Decreased _____ Stable _____

Health

1. Access to veterinary services.

Government veterinarian _____ Private veterinarian _____ Shop/Market _____

Other (specify) _____

2. Number one death causing disease/parasite within your herd. _____

3. What kind of disease preventative medical procedures do you perform within your herd?

None _____ Other (specify w/ drug name) _____

Other

1. What kind of natural disasters does your herd often face?

Flood _____ Drought _____ Other (specify) _____

2. Biggest challenge faced by herd. (specify) _____