The World Food Prize Foundation Borlaug/Ruan Internship Report:

Observations of Cattle Production and Trypanosomosis in Rural Ethiopia

Bill Tiedje

International Livestock Research Institute
Addis Ababa, Ethiopia

Contact Information:

Bill Tiedje 9648 E. 36th St. N. Newton, IA. USA

Tel: (641) 792-9470

Email: btiedje@gmail.com

Introduction

Visiting a country where only one third of the population has electricity, yet being able to easily communicate with the rest of the world via, email shows the differences that exist between the developed world and the areas of the world living without modern luxuries. Technology, however, may be the key to help bring these impoverished people the security and stability of the 21st century as it can spread ideas and information everywhere. With knowledge, the world's poor can empower themselves and provide their children with a brighter future. An effort to spread knowledge by organizations such as the World Food Prize Foundation and the International Livestock Research Institute will greatly help in stabilizing impoverished countries and feeding the world's poor.

Food security and production have been interests of mine since an early age. I live on a family farm with my parents and brother. We cultivate 600 acres of land in central Iowa, raising corn and soybeans, as well as about 100 head of beef cattle. I am especially interested in beef production and breeding programs. I own four head of beef cattle for an FFA (Future Farmers of America) project, a student agriculture program at my high school of which I have served as president and now am residing as secretary. Through FFA, I have developed interest in animal breeding practices and the beef industry. My interest in international agriculture practices and policies led me to the World Food Prize Youth Institute.

During my sophomore year at Newton Senior High School, my biology teacher recognized me as an excellent candidate for this program and encouraged me to participate. I began to research livestock production in Central America, hoping to write a paper about possible agriculture production improvements. However, as I researched this topic, I began to understand that local breeds and farming practices were well adapted to their environment. Instead, the reason these small subsistence farmers were struggling to make a living was partially due to policies such as CAFTA (Central American Free Trade Agreement). These new polices were introduced in hopes of adding these

farmers into the international market, and in turn, helping them to rise out of poverty. Yet the international market today can be a vicious environment for smaller producers without protection from massive price drops or extreme fluctuations in the market. I concluded that these small farmers owning only a few acres of land needed some help in this volatile market and should be protected in trade agreements, so that they are able to support their families and emerge from severe poverty. This was the basis of my paper I presented at the 2005 World Food Prize Youth Institute in Des Moines, Iowa.

I learned a wealth of new information about the workings of the scientific community at the various seminars during the week of programs at the 2005 World Food Prize ceremonies. I was able to talk to many professionals working with food security across the world. From the head of biotechnology companies, to international scientists working to lead developing nations out of poverty, I met countless honorable professionals who were doing their part to help the world's poor. During that enthralling week, I also learned of the students who participated in the Borlaug-Ruan Summer Internships across the world at various research stations. I was captivated by the idea of being able to work alongside highly reputable scientists in the field and discover how scientific research was conducted. I saw it as a way to do my part to help improve international food security. After hearing former intern's testimonies of their exciting travels to foreign countries, I was convinced I wanted to participate. I was amazed at how they were able to dive into new cultures and explore this diverse world we live in. I knew I wanted to be part of this international learning community and discover more about poverty reduction and food security around the world.

After applying for the internship and going through the interview process, I rejoiced upon learning that I had been accepted as a 2006 Borlaug-Ruan Summer Intern and would be traveling to Ethiopia to study at the International Livestock Research Institute (ILRI). I began researching this institute and learned of the ingenious, innovative projects ILRI researchers are working on today. ILRI's work with livestock was a perfect match for me, and I was excited to learn of the farming

practices in the ancient country of Ethiopia. ILRI is a public international agriculture research center and is part of the Consultative Group on International Agriculture Research (CGIAR). ILRI is based in Nairobi, Kenya with a principal site in Addis Ababa, Ethiopia (ILRI 1999). Its stated goal is, "By positioning itself at the crossroads of livestock and poverty, and by bringing to bear high-quality science and capacity building, ILRI and its partners will reduce poverty and make sustainable development possible for poor livestock keepers, their families and the communities in which they live" (ILRI, 1999). Scientists at ILRI hope to alleviate poverty by improving livestock systems in developing countries, allowing farmers there to pull themselves up and rise out of poverty.

ILRI will play an extremely important part in the next food revolution, the Livestock Revolution (ILRI, 1999). Evidence of the Livestock Revolution is becoming exceedingly evident. The consumption of animal products in developing countries is rapidly increasing. For example, the amount of meat eaten in developing countries increased three times faster in the last three decades than the increase in developed countries, mainly due to urbanization, economic prosperity in these countries and change in food consumption patterns. This elevated demand has fueled a jump in livestock production in these developing nations (ILRI 1999). Livestock help to bring people out of poverty by providing proper nutrition, creating means of storing wealth, and stabilizing food security. They also create fertilizer for crops and strengthen economies in developing countries. However, if mismanaged, livestock can degrade land and water resources (ILRI, 1999). This is where ILRI comes in; it provides scientific guidance and management strategies for impoverished farmers in a practical and efficient manner.

The Internship program at ILRI

My project at ILRI focused on Trypanosomosis in the Ghibe valley of South Western Ethiopia. Trypanosomosis is a tropical cattle disease that affects nearly 1/3 of the African continent in lowland areas where the disease thrives. It is caused by a parasite which feeds on red blood cells in cattle,

causing them to become anemic and often is fatal. It is spread by Tsetse flies which pick up the parasite from infected animals when they feed on the animal's blood. The parasite grows and develops inside the fly. Eventually, the parasite reenters a new animal's blood stream from the fly's saliva when it bites the victim animal. ILRI has done extensive work to better understand and control this disease at their test site in the Ghibe valley in South Western Ethiopia. Before ILRI began work on Trypanosomosis control in this area, it was generally uninhabited. Any livestock brought to the low lying area were immediately affected with this terrible disease, making these livestock very sick, unproductive, and caused many deaths in domestic cattle (ILRI, 2005). Today, farmers are able to raise livestock in this area, through the use of pour-on insecticide treatments to kill the vector Tsetse flies, anti-trypanosomal drugs, and the selection of trypanotolerant livestock, or those animals which are able to remain productive under a large trypanosomosis challenge (Murray et al., 1983). However, Trypanosomosis still lowers the productivity and efficiency of livestock production drastically in this area (ILRI, 2005). My project is to record data on livestock health and productivity in the field, add this data to an existing computer database, analyze the data I have collected, and then share it with the ILRI scientists. The data that I collect will show if the parasite is present and determine the overall health of livestock in the Ghibe region.

Trypanosomosis affects nearly 10 million square kilometers of the African continent (University of Liverpool, 2006). Everywhere it exists, livestock and farmers feel it's effects, including loss of animal productivity and in severe cases death loss. By collecting more data on the effectiveness of treatments, trypanotolerant livestock, and other control methods, I helped provide scientists with more information which may help them better understand this disease. Today, scientists are at the stage where they are beginning to identify genetic markers for trypanotolerance. These new developments combined with data collected in the field, can be used to properly identify livestock that are disease resistant (University of Liverpool, 2006). If a system could be developed where livestock

disease resistance or tolerance could be identified, and could be traced through pedigrees, this would help livestock producers throughout the world. It would allow farmers to select for disease resistant livestock, just as they do for meat or milk production characteristics. Although my project is on a fairly small scale, I participated in a large international effort that could greatly improve livestock health and disease resistance worldwide.

While at ILRI, I had the chance to meet several scientists working in various fields. Each person I met and talked with taught me a unique lesson. I really enjoyed working at ILRI and interacting with international learning community there. We discussed everything from food policies to international politics over lunch or during break times. I found their perspectives on modern challenges facing the world very interesting. I met many talented professionals who were all willing to share their experiences and advice with me. It was a truly rewarding experience.

On my project, I worked alongside the Animal Genetics Resources Group of ILRI in Addis Ababa, Ethiopia. These devoted scientists have been working to improve livestock production and better understand Trypanosomosis in the Ghibe valley since 1985. Initially, they began by trying to understand the situation that existed in this area. Eventually, they began testing Trypanosomosis control methods in the Ghibe valley. Today, the animal genetics resources group consists of 10 people at the Addis Ababa campus. These people consist of animal breeding/genetics experts, animal health specialists, and statisticians. In the Ghibe area, they employ five field assistants who assist in data collection and analysis in the field. The animal genetics resources group, in addition to their work on Trypanosomosis control and other field projects, instructs many students and beginning scientists on their work. I'm very grateful for the chance to be a member of this team for one summer and have certainly learned a lot from their teachings. My supervisor, Dr. Workneh Ayalew, has done extensive work on Trypanosomosis control and identification of local trypanotolerant cattle in the Ghibe valley and else where in Ethiopia. Upon meeting him and discussing my project, I could tell he was very

committed to his work and felt very strongly about protecting the existence of local cattle breeds. He took time out of his busy schedule to explain to me the importance of the project I worked on and the history of Trypanosomosis.

Collection of field data

My project was divided into three sections: data collection, data analysis, and finally drawing conclusions from my project and sharing them with others in the group. After doing some reading and research on Trypanosomosis to establish a good understanding for my project, I headed to the rural Ghibe valley to begin with data collection. We rode 4 hours in a packed-full pickup west from Addis Ababa to the village of Welkite which is located on the western border Ghibe valley. The data I collected and recorded in the field included information on cattle health, trypanosome presences, and PCV levels in the Ghibe region. The ILRI driver and I joined a team of ILRI scientists in Welkite, a small village near the Ghibe valley. This was my first time to see true Ethiopian culture. Arriving on a Sunday, we had time to spare and my driver/guide showed me around the village and taught me about Ethiopian culture. On this initial trip, I found many new, intriguing experiences that I'm sure I will remember for the rest of my life. From meeting children who screamed, “You!” upon seeing me, to sleeping in a hotel with a broken, completely dismantled toilet and no running water; it was quite an experience for me. I think I grew a lot on that first trip as I was forced to immediately adapt to a new, and very different, culture. That experience changed me for the better, making me look at the world in a new light. It was not the extreme poverty or poor living conditions that shocked me the most. Instead, these brave people's ability and determination to carry on despite such hardships amazed me the most. Their hope for a brighter future thoroughly impressed me. Rather than complaining about the troubles they faced, they looked to the future and sought to provide a better future for their children. One day, as we sat sipping our tea after a long day’s work in the field, I showed my guide pictures of my farm back home in Iowa. He told me that day, “You must strive to do better than your father.” I sat there on the porch of the little hotel overlooking the poor village dotted with shacks and mud huts

and streets full of cripples, beggars, and hungry cows and goats looking for scraps of food and it all made sense to me. That was the goal of these impoverished people - to move up one step from the former generation and strive for a better life. This realization reminded me why I was there with ILRI in the first place - to help farmers improve their livestock operations, allowing them to better provide for their families and give their children the chance for a better life. The next morning we set out for the first research station in the Ghibe valley and began the data collection.

The ILRI team first visited the Lower Ghibe research station, which is located in the Southern People's Region in the Gurage Zone. We departed from the nearby village of Welkite early that morning as the cool night air still loomed and the sun had not yet risen. Immediately upon arriving, we began to set up the cattle chute and electronic balance needed to collect necessary information. This location was quite remote and since there was no electricity available the electronic balance was powered by the truck's battery. Many of the local farmers assisted with setting up the equipment, while others herded their cattle into the holding pen attached to the chute. This equipment included a makeshift cattle chute, large electronic balance, and an assortment of microscopes, centrifuges, and other scientific tools used for analyzing blood samples. Once the equipment was prepared, the group began moving the cattle into the chute. A sufficient number of cattle were herded into the makeshift chute. Starting from the front, each animal's ear tag was read, recorded, and a blood sample was taken from a vein on the right ear into a capillary tube after piercing it with a sterile needle. These tubes were then numbered and sealed (ILRI, 2005).

These blood samples were analyzed using the DG (Dark Ground) technique. This technique was used to determine the level of parasite infection. The PCV was also determined using the buffy coat technique (Leak, 1999). In this test, blood samples are put into a centrifuge to separate the different parts of the blood. The centrifuge works by separating the blood into different parts because the different parts have different densities. The red blood cells are the densest and are "packed"

farthest out in the tube. PCV is calculated by measuring the volume of red blood cells in relation to the volume of all the blood taken in the sample. When the parasite is present in the animal's blood, it collapses the red blood cells, making the animal anemic (Murray et al., 1983). In other words, if the parasite is present, the animal will have fewer blood cells; and, therefore, lower PCV.

The different parts of the blood separated by the centrifuge are the plasma, at the inside end of the tube; an undetectable layer of white blood cells, in a thin layer called the buffy coat; and finally the red blood cells, at the outside (Murray et al., 1983). A cut was made in the tube a little more than 1 mm below the meeting of the plasma and blood, in the buffy coat layer. From this spot, blood was taken out and placed on a microscope slide and a cover was put on top. These slides were analyzed by the ILRI scientists to determine if the parasite was present in the blood (Murray et al., 1983).

The parasite that was most commonly found was *Trypanosoma congolense* (Table 1), which on the slide can only be seen as a moving white blood cell. Different species of Trypanosomes are distinguished by their movements on the microscope slide. *Trypanosoma congolense* is small, sluggish in movement, and adheres to red blood cells by anterior end. *T. vivax* is large, extremely active, moves across the slide quickly, and pauses only occasionally (Murray et al., 1983). I had the chance to examine several microscope slides and the difference between the parasites was quite easily distinguished. *T. congolense* just wiggled in one place, while *T. vivax* moved all over the slide. When observing slides using the DG method, you cannot actually see the parasite; instead, you see red blood cells that have been infected moving irregularly on the slide. A third type of parasite, *Trypanosoma theileri*, was also found in a few cases. However, *T. theileri* is non pathogenic and has no effect on animals' PCV (Murray et al., 1983).

In addition to determining the species of parasite and PCV, the parasitaema, or level of infection of the parasite, is determined. This is done by estimating the number of parasites present per slide and then referring to a chart which relates the number of parasites to each level of infection (Leak,

1999). For example, a parasitaema score of 1 would mean there was only one parasite present on the slide. If 2-10 parasites were present it would be considered a level 2. This scale goes up to a level 6 which indicated parasite swarming, or over 100 trypanosomes per field (Murray et al., 1983).

While the blood samples were being tested, I assisted the farmers in balancing and reading cattle's ear tags. I have considerable experience handling cattle from work on my family's cow-calf beef operation in central Iowa, and I found these small Zebu breeds to be quite small and docile. The corral and chute used to sort and hold the cattle were in need of repair but were sufficient for this job as the cattle were very tame. A helpful upgrade to this corral system would be a head gate used to restrain livestock while balancing cattle or reading ear tags. Several cows jumped through the end of the chute, and it was not possible to get accurate balance readings for these animals. Such a head gate can be made from steel or lumber and does not require a large amount of supplies or money to construct. Also, the use of a system of gates that can easily be opened and closed to move cattle quickly through the corral would eliminate the need to whip the animals, which can damage their hides and bruise meat, and would keep farmers out of danger from aggressive animals. However, such a system may be an added expense that is not extremely critical.

Once all of the blood samples were analyzed, animals with low PCV levels (below PCV value of 20), blood samples with heavy parasite loads found in them, or those animals displaying obvious signs of the disease were treated by administering a trypanocidal drug, Berenil®, by syringe in the neck. This drug, Diminazene aceturate, provides protection against natural infection for up to 3 weeks at a dose of 7mg per kg^{-1} body weight (Leak, 1999). Restraining cattle while attempting to treat the animals was often a problem. A sturdy, self-built cattle head gate would also help immensely when delivering such treatment and would ensure the full dosage was given to the animals and none was lost while attempting to wrestle the animal into submission.

This process was carried out over the next week at various sites across the Ghibe valley and the

surrounding area. Each day, the process was done in the same manner and preceded without any major setbacks. The balance, however, was not functioning properly one day, and it took a long time to fix it and assure that the readings were accurate. Besides that one incident with the balance and a few frisky cattle jumping out of the corral, the tests proceeded flawlessly. The group of cattle we treated varied in size and breed from day to day. The Bridge village contained the most animals with 128 animals and the Wayu village holding the least with 84 (Table 5). The ILRI team eventually traveled to the Abelti village on the far side of the Ghibe River and up the escarpment. This test station was located in the Jimma zone in the Oromiya region. The process at this station was the same as carried out at the Bridge station. Blood samples were taken and identified and then examined using the buffy coat technique, animals were balanced, and ear tag identification numbers were verified. In addition, the sex of the animals was recorded and after the trypanocidal drugs were administered, pour-on insecticide treatment was applied on animals in need of treatment. The corral at this site was in worse shape than the Bridge site but because these cattle were so small and docile, they could be maneuvered and handled quite easily.

After working the cattle data collection for several days testing cattle for trypanosome presence, I accompanied a different group of scientists who were determining the Trypanosomosis challenge in an uninhabited area of the Ghibe valley for use as a future test site. These scientists hope to move their large test station located in the upper Ghibe to this new location. At the existing site in Upper Ghibe, there is a plan to construct a large water dam for hydroelectric power station. This project will affect the research station, and preparations are being made for relocating the facilities to a suitable new site. However, to make sure that Trypanosomosis is in this area, making it a useful test site, tsetse flies must be caught and tested to determine trypanosome presence. Five bi-conical traps were set throughout the valley. Arriving at the nearby village early in the morning, we joined two local farmers who helped set the traps and guide us through the mountains and brush. Traps were set in highly visible areas, so flies

could see them from a distance. First, grass below the traps was cut or pulled and tall grass surrounding the trap area was knocked down to increase visibility. Next, a wooden stake was pounded into the ground to make a hole where the trap could sit. The tall trap stake was then put in this hole and the bi-conical trap was slid over the top. A metal bracket was fitted on the end of this tall stake to hold the trap net up. Finally, a small rectangular box, with sides made of insect netting, was placed on the top of the box to catch the flies. The trap works by first attracting the flies with the blue color in the bottom half of the trap (Leak, 1999). Once the flies get to the trap, they prefer to land on the black fabric on the inside of the trap. When they attempt to leave, they fly upwards into the netting. Eventually, they make their way to the box on the top.

The Ghibe valley is very green and lush during the time of year I visited. It reminded me of the Rocky Mountains yet it was covered in dense foliage making the landscape green as far as the eye could see. After setting all the traps, we walked down to the river to see what kind of water access the livestock could have. Dr. Woudyalew Mulatu mentioned constructing a dam in this area to hold water for the dry season. I agreed and added that through the use of plastic pipe, water could be carried to different parts of the area if some livestock are to be kept separate. On my family's farm in Iowa we use a system similar to this to transport water to various paddocks and it works very well. Plastic hose is relatively cheap and the presence of water often is a limiting factor in where livestock can be raised. This system would eliminate that problem. The steep embankments surrounding this area made a natural boundary separating this area from other animals and people which would be very important if a test station was to be established at this location. I learned much about the customs and daily life of Ethiopians living in rural communities while collecting data in the Ghibe valley. It was a truly eye-opening experience and brought many new questions that with the help of my supervisor I was able to answer in my data analysis.

Entry of research data in to computer database

After I completed the data collection portion of my project I returned to the ILRI campus in Addis Ababa to enter the data we collected into an existing database. The program used to hold all the data was Microsoft Excel. Previous to this project, I had no experience with spreadsheet programs such as Excel. Luckily, my supervisor was able to teach me the basics of using spreadsheets. Now, I can use it without any trouble. I entered all the data we collected in the field into the database. This included records on 417 animals' health, body masses, parasite presences, parasitaemia scores, ID numbers, PCV levels, owners, and locations. By adding all of this information to a computer database, I helped to organize it so scientists can better analyze the data collected. This way all the information can be shared and accessed easily. In addition, computer programs such as Excel can add, average, and count specific characteristics. Once all of the information was inserted into the computer database, I was able to begin with analysis.

Analysis of the data

The analysis portion of my project was greatly simplified by computer programs such as Microsoft Excel® and other data analysis programs at ILRI I was able to use. The data I collected could be used to draw many conclusions about livestock operations in the Ghibe valley; however, in this project, I am focusing on Trypanosomosis presence, control, and overall animal health. My project was a small portion of a larger project ILRI is working on in the Ghibe valley. It should be noted that since the data I have collected is a relatively small amount and over a short period of time it may not be an accurate representation of overall animal health in the Ghibe area. Animal health and Trypanosomosis presence varies greatly during the year and all of the data I collected was at the beginning of the rainy season. That being said, many conclusions can be drawn from the data I have collected.

Interpreting results of the data analysis

The first important goal of my project is determining that Trypanosomosis is indeed still present in the Ghibe valley. Of 417 animals tested, parasites were found in the blood of 46 animals (Table 1). This means that disease prevalence in the experimental herd was 11%, i.e. ([46/417]*100%). In addition, 16 animals were found to be parasite-free. However, when their blood samples were examined, they showed other signs of the disease including low PCV levels. In the Ghibe area, PCV levels of 25 and higher are considered healthy. One would assume that since parasite-free animals are in better health, they would have a larger body mass than sick animals. However, the data I collected showed that on average, animals with the parasite were larger (Table 1). This contradiction can be easily explained. This data most likely shows that young cattle are less likely to become infected. In fact, Table 3 shows that 70 kg calves are indeed found among the non-infected animals. That explains why healthy animals are lighter overall. Trypanosome presence is quite evident in the cattle in the Ghibe valley and reinforces the importance of its control.

The next question to be addressed after the presence of trypanosomes is which type of trypanosome is most common. The data shows that *Trypanosoma congolense* is the most common with 22 occurrences out of a total of 46 (Table 2). It is also the most detrimental to animal health causing an average PCV of 20.7(Table 2, Figure 3). In the Ghibe area, 25 or better is considered healthy and animals with a PCV under 20 are treated with Trypanocidal drugs. *T. vivax* is also quite common with 20 occurrences but was slightly less harmful causing an average PCV of 22.7 (Table 2, Figure 1). A third type of parasite, *T. theileri*, was also found in four cases, but it is non-parasitic and does not lower PCV whatsoever. This characteristic of *T. theileri* is very obvious in the data which shows the average PCV in animals with *T. theileri* is 27.7 (Table 2, Figure 2). It appears that *Trypanosoma congolense* is the most harmful in this area since it accounts for the most infections, results in lowest PCV, and causes the highest levels of parasitaemia (Table 2, Figure 3). *T. vivax* also is a problem contributing to a large number of cases, lowering PCV, and created high levels of

parasitaemia. (Table 2, Figure 1).

All the parasites occurred at varying levels of parasitaemia. Three hundred seventy one animals were determined to be at a parasitaemia rating of 0 meaning no parasite was found. These animals averaged the lowest body mass of 196.9 (Table 3). This number is misleading because of the calves included in this category. The minimum body mass recorded for animals with a parasitaemia of 0 was 70kg showing the presence of calves in this category (Table 3). If calves were removed from this category and only adult animals were tested, it would most likely have the highest average body weight. Table 3 more accurately shows the health of these animals. It shows that these parasite-free animals had an average PCV of 24 which is relatively healthy (Table 3).

An inverse relationship between parasitaemia and body mass becomes more evident as the parasitaemia level rises (Table 3). As the parasitaemia load increases, the average body mass gradually drops. In addition, the parasitaemia load is also inversely related to the PCV (Table 4). However, this is not as clear in the data table because the small amount of data collected. In fact, looking at animals with a parasitaemia of 5, it seems these animals may possess some degree of Trypanotolerance. Despite having a severe trypanosome load they were able to maintain a relatively healthy PCV of 24 (Table 4). ILRI will keep track of these animals and watch to see if further tests support this conclusion. ILRI scientists suspect that trypanotolerant cattle do exist in local cattle breeds. This data proves that the degree of infection does indeed affect the animals' health greatly and presents some evidence of trypanotolerance in the Ghibe valley.

In addition to describing the effects of varying levels of parasitaemia, table 3 shows the average body mass for animals in this area was around 196.8kg (Table 3). Livestock in the Ghibe valley are small-framed, hardy animals. This allows them to survive in times of food shortages and deal with adverse conditions better. If larger, more productive, exotic breeds of cattle were introduced into the Ghibe valley they would not be able to cope with harsh conditions and require much more maintenance

making them impractical for local farmers.

Data for my project was collected at four different villages: Abelti, Bridge, Gullele, and Wayu. Frame size of the animals varied significantly between the different locations. Livestock at the Wayu village were much larger than others, averaging close to 217kg compared to the overall average of 198.7 kg (Table 5). Bridge and Gullele villages had the lightest average body masses around 190 kg. Abelti was in the middle, averaging a body mass of around 197 kg (Table 5). These two differences could be the result of several things. It could be that there were more calves at the Bridge and Abelti villages; the data would fit this conclusion since the minimum weights of animals at those villages were also the lowest (Table 5). Another possible explanation is that animals at the Wayu village are simply of larger stature. This would fit the data as well because the largest weight recorded was at the Wayu village (Table 5). Information on the animals age related to weight would be needed to fully resolve this question.

The information I have collected, although quite basic, can be used to determine several factors affecting livestock production in the Ghibe valley. Information on animal health, frame size, trypanosome presence, and evidence of trypanotolerant livestock have been collected through my project. The data collected and conclusions I have drawn through this project will be added to ILRI existing knowledge on livestock production in the Ghibe valley.

Presentation of findings

Once I had organized my final conclusions and discussed my findings with my supervisor, I gave a PowerPoint® presentation to a group of scientists and students here at ILRI. As well as explaining my findings, I also spoke about the World Food Prize, my farm background, and the wonderful experience I had on this internship. I described how I greatly appreciated the determination of rural farmers and encouraged the ILRI scientists to keep up the good work. When I finished my seminar, I answered questions and received comments about my project. Everyone was very

supportive and helped me improve my presentation by sharing their ideas. I explained to them that I planned to present my seminar to others in the United States as well, so any suggestions were quite welcome. My presentation went well, and I hope to be able to continue to share my experience with others.

Visit to farmers participating in fattening trial

During my stay here in Ethiopia, I had the chance to see a few of the other projects ILRI is currently working on. Besides working on my Trypanosomosis project in the Ghibe valley, I also accompanied Dr. Tadelle Dessie to inspect ILRI's new cattle feeding program in the Ghibe area. We traveled to several small farms to see the livestock in the program. These animals were being fattened to ideal market weight in an effort to boost profits. ILRI supplied these farmers with information and training on properly feeding these animals. The purpose of this experiment was to demonstrate to farmers in the Ghibe valley one way of raising benefits they get from their livestock, and at the same time to demonstrate a profitable way of disposing cattle not needed for other immediate uses. My task on this particular trip was to see how the trial is undertaken and take detailed photos of each animal. Upon returning to Addis Ababa, I gave these photos to Dr. Dessie, so they may be used to assess the growth and health of the animals at the end of the project.

Visit to ILRI Debre Zeit research staion

Towards the end of my stay in Ethiopia, I was able to visit ILRI's test station in Debre Zeit. I visited the large forage gene bank, dairy barns, and small ruminant nutrition research facilities there in addition to the seed and dairy processing facilities. Established over 30 years ago, the Debre Zeit site has a long history with ILRI and borders the beautiful Crater Lake. ILRI maintains the forage gene bank there in an effort to keep native plant species from becoming extinct as well as raising seed that can be distributed to farmers. Dairy production research at Debre Zeit has been a very successful in helping small farmers. The site is used to teach farmers new management techniques and present ways

for farmers to diversify their produce. A perfect example of this innovation is an improved butter maker ILRI developed. It is made from locally available products and reduces the time to churn milk into butter from 2-3 hours to 30 minutes. I really enjoyed my visit to Debre Zeit and found it to be a perfect example of ILRI's effort to provide farmers with practical new technology and information.

Conclusions

Although I played a small role in ILRI's effort to manage Trypanosomosis during my short stay in Ethiopia, my project will add to the immense amount of knowledge and data on the disease that already exists. Therefore, I am helping scientists to better understand and control this damaging disease. Through my work on this project, I have learned much about the scientific process of collecting, analyzing, and sharing new information and data. Working with the livestock farmers and diving into the local culture in the Ghibe valley was a wonderful, life changing experience for me. From eating *Injera*, a very new and different food to me, for almost every meal for a week, to hiking through dense bush in the Ethiopian mountains, it was a great adventure. I will always remember those farmers determination, bravery, and desire to better provide for their families combined with their obvious love for their livestock. Today, living in a modern country, we take many things for granted. Yet even though the people I met in Ghibe didn't have the luxuries we have in the U.S., that did not discourage them. No, most Ethiopian farmers don't have a lot of money or material wealth. Instead, they enjoy the simple life and the company of their friends and family. This bright outlook on life is very refreshing. I am very thankful for being able to participate in this amazing program and will carry with me the knowledge I have gained here for the rest of my life.

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Table 1		
Parasite Presence	Number of Animals	Average Body Mass
No	371	196.8976
Yes	46	200.2174

Table 2		
Type of Parasite	No. of Animals	Average PCV
T. congolense	22	20.7273
T. theleri	4	27.7500
T. vivax	20	22.7500
None	371	24

Table 3				
Trypanosomosis Load	Number of Animals	Average Body Mass (in kg)	Minimum Body Mass (in kg)	Maximum Body Mass (in kg)
Level 0	371	196.8976	70.0000	336.0000
Level 1	13	214.6154	131.0000	303.0000

Table 4		
Trypanosomosis Load	Frequency	Average PCV
0	371	24
1	13	24.1538
2	6	22.0000
3	11	20.9091
4	13	21.0769
5	3	24.0000

Table 5					
Village	Number of Animals Total=417	Average Mass	Std Dev	Minimum	Maximum
Abelti	95	196.7789	48.6540	97.0000	306.0000
Bridge	128	190.0000	39.6318	95.0000	294.0000
Gullele	110	190.9182	51.6083	70.0000	309.0000
Wayu	84	217.1905	52.5331	105.0000	336.0000
Overall Average	104.25	198.72	48.11	91.75	311.25

Figure 1

T. vivax

LOAD	Frequency	Percent	Cum Percent
1	5	25.0%	25.0%.
2	3	15.0%	40.0%.
3	6	30.0%	70.0%.
4	3	15.0%	85.0%.
5	3	15.0%	100.0%.
Total	20	100.0%	100.0%.

Figure 2

T. theileri

LOAD	Frequency	Percent	Cum Percent
1	4	100.0%	100.0%.
2	0	0.0%	100.0%
3	0	0.0%	100.0%
4	0	0.0%	100.0%
5	0	0.0%	100.0%
Total	4	100.0%	100.0%.

Figure 3

T. congolense

LOAD	Frequency	Percent	Cum Percent
1	4	18.2%	18.2%
2	3	13.6%	31.8%
3	5	22.7%	54.5%
4	10	45.5%	100.0%
5	0	0.0%	100.0%
Total	22	100.0%	100.0%