

2001 World Food Prize Internship at the International Centre for Research in Agroforestry

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Acknowledgments

I need to thank the staff of the International Centre for Research in Agroforestry for giving up their time to show the laboratory and answer my numerous, and sometimes naïve, questions. I owe a special thanks to Dr. Smithson, Mrs. Smithson, Teresa Borelli, Mercy Nyambura, Margaret Nyambura, Priscillah Nyamai, Ben Le Roith, and Anje Boye for explaining the lab work in detail, talking about the interesting people of Kenya, making comparisons with their homelands, taking me to exotic locals, and keeping me company.

I need to thank the World Food Prize Foundation for setting up and paying for this experience. The internship program is a great asset to the state of Iowa by permitting Iowa youth to discover cultural differences and learn what makes Iowa unique. I especially need to thank Lisa Fleming for answering my never-ending stream of questions.

Humanity has left and continues to leave a worthwhile history through our rawest, most distinguishing, and basic trait: the ability to change our surroundings extensively. Among this urge's eclectic achievements, agriculture is the most significant. Interest in agriculture permeates all civilizations, whether as a farmer, or indirectly as a sociologist studying the urban setting that agriculture has permitted with its creation of a permanent homestead.

I, Troy Fadiga, represented Centerville High School at the 2000 World Food Prize Youth Institute. At first I was apprehensive about discussing the safety of genetically modified organisms, an agricultural and science issue, when I've lived in town my entire life. I, at first, thought that without the background in farming I would be at a disadvantage when writing about the topic and discussing the issue with other attendees. Soon the apprehension faded as I realized that because of little pre-exposure to the farm setting, I was in a position to make an unbiased analysis. The Youth Institute ran smoothly and the input from world experts altered my views of genetically modified organisms.

My interest in the internship was actually sparked before the Youth Institute when my close friend, the chosen intern for the Center For International Forestry Research in Bogor, Indonesia the year before, Elizabeth Wagner, talked with me about her work, direct examination of natural resource problems, and experiences with experts in their fields. We both had agreed that my abilities and interests were ideal for such a position.

I was selected to intern at the International Centre for Research in Agroforestry (ICRAF) in Nairobi, Kenya. The center was set-up in 1977 as an independent research body supported by the Consultative Group on International Agricultural Research. ICRAF's goal, at its most basic level, is to put trees on farms. ICRAF's simple, yet effective approach of placing trees on farms

is now widely seen as one of the few approaches that can reduce poverty, improve food security, increase soil fertility, and protect the environment, all at the same time. The soils research being conducted received high praise from Dr. Borlaug; it prompted him to claim the research is, “...the most pertinent and highest-quality soils research that I have seen to date in the [Consultative Group on International Agricultural Research] system” (qtd. in Trees of Change 7)

I worked in Programme 3, *Ecosystem Processes and Management Programme*. Its goal is to understand the impact of land and water management practices on the surrounding ecosystem while improving the production of marketable products. I worked in Project 3.2 where carbon and nutrient cycling is studied to help find the best way of reducing soil nutrient depletion through combinations of organic and inorganic nutrient sources (Staff List 2001 27). My background in chemistry and experience with laboratory work in my electronics classes made my placement ideal.

My supervisor and host during my first two weeks was Dr. Smithson.. Dr. Smithson received his Master’s Degree in wildlife biology and his Ph.D. in soil sciences from North Carolina State University. Dr. Smithson has been with ICRAF since September of 1993; he plans on leaving ICRAF at the end of 2001 (Staff List 2001 28).

While in western Kenya I was primarily under the supervision of Teresa Borelli, the Italian Associate Soil Biologist. Borelli received her MSc in advanced ecology from Durham University in the United Kingdom. Borelli joined ICRAF in January of 2001 (Staff List 2001 68).

I also had the pleasure of meeting and working with many other ICRAF staff members. During the beginning and end of my internship I worked with and learned from Margaret Nyambura, an undergraduate student, and Mercy Nyambura, a laboratory attendant. In the lab in

western Kenya I worked with Priscillah Nyamai and Henry Musasia. I also spent several days with Anja Boye, the Danish Associate Soil Scientist, observing the rainfall simulator.

On my first day at ICRAF I received a tour of headquarters and listened to Dr. Paul Smithson give a presentation of the research ICRAF is doing and issues affecting Programme 3; it included where research currently is in finding economically feasible ways to boost phosphorus (P) and nitrogen (N) levels in the soil and how the incorporation of *Tephrosia vogelii*, *Crotalaria grahamiana* and other woody leguminous species can help improve soil fertility. He then reviewed the need for suitable cropland and how a land shortage drives some to attempt farming steep slopes and other marginal and fragile lands. I spent the next several days reading about beans in eastern Africa and their importance as an inexpensive source of protein. I also studied the use of *Gliricidia sepium* for shading tea plants, providing a source of nutrition for ruminants, providing stakes for climbing beans, supplying green manure for grain crops, and providing a supply source of firewood for domestic needs. I then went on to read an ICRAF corporate report; I found the idea of using drama for the dissemination of information intriguing (Paths to Prosperity 40).

I then spent several days helping to weigh samples for the recently acquired Carbon-Nitrogen analyzer. It was an exploratory period where I assisted in software testing, I helped run blanks, and I aided in calibration attempts. After coming back to Nairobi during the final week of my internship, I was pleased to see the instrument being used to process actual samples.

Phosphorus (P) is found in the soil in numerous forms, from both organic and inorganic sources. Only a small percentage of the soil's phosphorus is found within the microbial fraction of the P pool, but it is an extremely active fraction with a rapid turnover rate due to microbe death and decomposition. This process leaves P that is usable by the crops and other plants.

After my introductory period with ICRAF, I was then placed with Mercy Nyambura and Margaret Nyambura to determine the amount of phosphorus found in the soil microbial biomass. The extraction was the first in a series of extractions testing whether or not the use of improved fallows as green manure causes more phosphorus to be available for crops by improving phosphorus cycling through organic fractions including microbial fraction.

We determined the microbial fraction of P by extracting the P from a sample set fumigated with chloroform and subtracting the amount of phosphorus extracted from a non-fumigated set. We then had a third set to determine the recovery rate of the first two sets. We added a known amount of P to the third set and then extracted the P. After subtracting out the amount of P extracted from the non-fumigated set and dividing by the amount of P added, we arrived at our recovery rate and used this to correct our previous numbers.

The data, if the hypothesis were correct, would show higher microbial biomass phosphorus content in the fallow treatments than in the sole maize treatment. Unfortunately, the data revealed no statistically significant difference in the numbers. There are several possible reasons for this: the soil sampled had an extremely low recovery rate, so the phosphorus might be there, but it might be too difficult to extract or it may take several years for the difference in phosphorus to become measurable. After all, Kakamega Forest, a very fertile site didn't get fertile soil in one year, and the nearby farms, extremely infertile after decades of continuous maize production, didn't get poor soil after just one year.

Research into cost-effective methods to improve the cycling of P is vital in ensuring food security. Some have called the P deficiency of the soil in Sub-Saharan Africa the main biophysical cause of rural poverty. Cost-effective methods for improving the cycling of P can

turn unusable forms of P into forms more quickly, improving yields and thereby reducing poverty.

Enzymes would be an ideal indicator of soil fertility because enzymes are closely related to soil characteristics that determine soil quality, such as organic matter, aggregation, and microbial activity. Enzymes react more quickly to changes in land management than conventional indicators, and require simpler procedures than many conventional methods, potentially reducing the cost of sample processing.

In the second project to which I devoted a fair amount of time, Teresa Borelli was developing a new method protocol for using enzymes as indicators of soil fertility under several land use systems in western Kenya. Several methods already exist but have shown levels of repeatability that are lower than desired. Borelli hopes to overcome this by adding known amounts of soil and forest litter to the slurry instead of determining the soil-slurry ratio afterwards by drying an aliquot of the slurry. While I was there, we measured the amount of product from the enzyme-substrate complex for four substrates: paranitrophenyl-beta-D-glucopyranoside, paranitrophenyl-phosphate, paranitrophenyl-beta-D-cellobioside, and paranitrophenyl-N-acetyl-beta-D-glucosaminide, initially and then at one, two, three, four, five, and six hours to determine the ideal incubation period.

While participating in this project, I spent time processing many samples with the spectrophotometer. I learned to gauge how much of a sample would be needed to get a stable reading, and when I needed to sample water so the next sample would be read properly. I would then record the results and assist in the cleaning. Due to a faulty pH meter, a batch of enzyme assays and acetate buffer was unsuitable for our samples and halted our progress temporarily. The data collected had shown fair repeatability for the incubation periods; however, before the

new protocol can be completed, research needs to be done on how the soil depth of the collected samples affects the enzyme levels and seasonal variability in enzyme levels. After arriving back in the United States, I received the data for the rest of the samples with the enzyme assays and acetate buffer; it too revealed fair repeatability. The shape of the graph is not the same for all enzymes and the correlation value of each of the data sets varies slightly; however, Graph 1.1 shows the typical repeatability of the protocol.

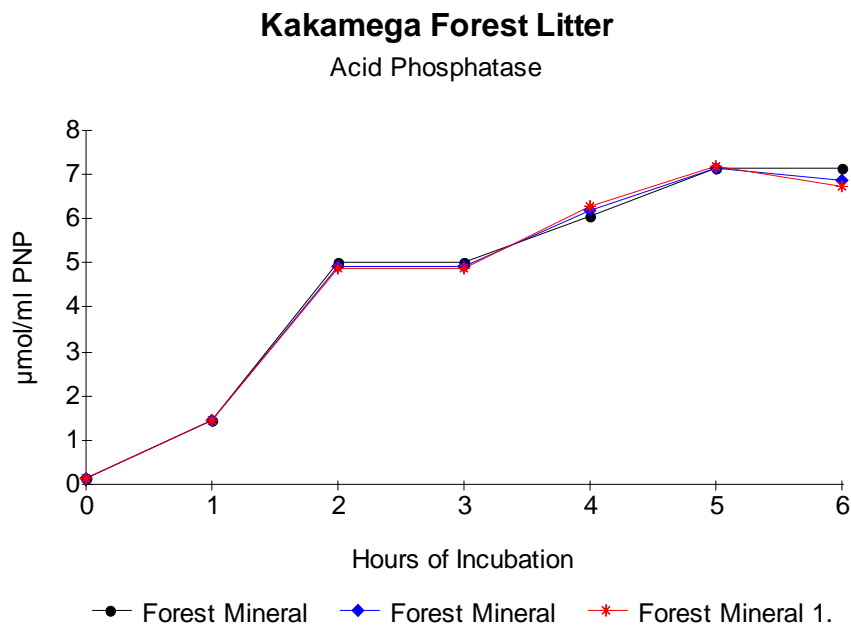


Figure 1.1

The use of enzymes as an indicator of soil fertility will assist in food security. The development of this protocol will allow scientists to project future soil conditions sooner, more accurately, and at a cheaper cost. This will allow scientists to divert the saved resources to other areas of interest and will reduce the cost of soil assessment in the fight against hunger.

While staying in Kenya I grew as a person, especially while living by myself for five weeks. My outlook on risk-taking has changed, and my social abilities have improved. I took

the opportunity to walk into the rural areas with a friend and meet some of the rural poor and gained a better understanding of the fight against hunger and poverty. In the cities I saw drug abuse and little children sleeping on the street, unaccompanied. Somehow, despite all these problems, the Kenyan people can still laugh. I came back from Kenya more grown-up and optimistic.

While in Nairobi I ventured out to a town called Thika where two rivers meet. Mrs. Smithson, my host and the wife of Dr. Smithson, and I went down to one river where there was a waterfall. We started walking along a path that ran between the river and a cliff to where the rivers meet. We couldn't get to where the rivers meet because a banana patch was planted there and blocked both the view and path. We cut through the banana patch and started along the path beside the second river. We were walking comfortably to the second waterfall when the path just stopped. We decided that we had gone too far to turn around so we went down to the river and jumped from stone to stone, wove a path around (and sometime through) thorny vines and stinging nettles, and then again worked our way back up against the cliff's wall. We finally made it to the second waterfall; it was well worth the effort. We climbed up the stairs carved into the cliff wall with our muddy legs, stinging from the sweat and dirt in tiny thorn cuts covering our skin. We cleaned up; Mrs. Smithson hosed off her legs while I took the more uncouth approach and climbed into the men's room sink. We then enjoyed a soda and agreed that we would have regretted turning back.

I used to take absolutely no risks; I believed that risks lead only to bad situations. My friends would groan whenever they suggested something because the first thing I would say was a long string of "what ifs." After living by myself in western Kenya, I quickly learned I had to risk sounding stupid, desperate for conversation, and juvenile if I was going to have anyone with

whom I could talk; after two evenings of solitude I was almost crazy. After realizing I had nothing to lose, I started talking with some of the students at the college and soon my afternoons were busy with conversation and weekends full of mishaps. When Mrs. Smithson and I were in Thika and the path to the second waterfall ended, we could have turned around, but we, instead, went forward and risked rough terrain. I now recall memories of the second waterfall's scenery, instead of wondering what it looks like. I do still realize that some risks, especially those placing myself in physical danger, are not worth taking, but that is a boundary only experience and mistakes can define.

My social skills and confidence have improved greatly since living on my own. Before going to Kenya I would avoid dancing; instead, I would just hold conversations with several of my friends. In Kenya someone told me "Dancing is like eating; you just need to." One night I went to a discothèque with several college girls. The establishment really wasn't the type of place I would normally go. The college girls forced me to dance and several college guys showed me some moves. I didn't dance long, but I had lost that nagging sense of self-consciousness. The improvement of my confidence after that was incredible. From my increased confidence and through the necessity of avoiding isolation, I began to just strike up conversations with people. I spoke with a schoolteacher on the street and was then able to get a tour of the school at which she taught. I talked with business owners in Kisumu and learned about government, business, and taxes in Kenya. When I arrived back home, I started talking with people I hadn't talked with in a long time. I've found day-to-day activities and social gathering much easier to attend since I've arrived back home.

I have learned that living on my own involves a great deal of responsibility, the largest of which was balancing my budget. My first evening in Maseno, in western Kenya, was awkward;

I kept expecting someone to come to my room in the guesthouse. After the realization that I was on my own sank in, the learning began. The next day I went to see where my laundry could be done. There was no laundromat with machines; my only two options were to use a basin or pay steep prices. I decided to pay the steep laundry price, but then I had to cut back on the number of taxis I took to nearby Kisumu where I did my shopping and ate out at nice restaurants. For the first time in my life I was completely in charge of my own budget. I sacrificed several taxi rides in exchange for not doing my own laundry, but I still paid for taxis instead of the cheaper matatus, trucks and vans used as public transportation, in exchange for safety. I came close to spending too much several times, but I did succeed in maintaining my budget enough so that I could eat every evening. For me, it was proving that I am capable of being independent. I imagine the experience will especially be of great use next year when I go to college.

I came to Kenya with my naïve conception of how the world is, but my stay altered my view of the world to the point where I almost gave up on people in general. I walked into the rural regions several times to visit various women's groups with my friend Ambrose Abol. The women had organized themselves to make pottery so they could sell the pottery and use the profits to put in a revolving fund. I also met a family of eight orphans; their parents had died from the HIV/AIDS virus. The eldest child was one year older than me and the youngest child was four. The children farmed the small family plot of land, but still went hungry and couldn't afford to send the younger children to school.

When I was walking on the streets of Kisumu, a city right on Lake Victoria, I saw many children who lived on the streets. I would see many of them walking around with little bottles of glue under their noses. I even saw an eight-year-old child sniffing glue. I remember walking

down a street in Kisumu one night and watching two street children start a fire on the edge of the road to stay warm. I know no other time where the world had seemed so helpless.

I was on one last trip with Abol to the rural areas. We were at a house where the grandmother was raising her grandchildren; the parents had died of disease. It was a mud-wattle home like the others had been, but then the grandchildren came inside and the grandchildren and the grandmother started laughing and smiling. All of the sudden *The Wasteland*, a poem I had read for my English class, made sense. In the end of the poem a knight, representing the disillusionment of the modern world following World War I, travels to an abandoned church and as long as all he sees is despair and nothingness, that is all he will receive. When all seems lost in the dryness, signifying a sterile, soul-less “living,” the knight must maintain his faith. The rain, life, follows after the knight continues his quest to an abandoned church and doesn’t lose faith. When the grandmother and grandchildren were laughing I realized that these beautiful people have maintained hope and overcome their wasteland.

The agriculture researchers have a long road ahead of them. Food security problems are a combination of social problems, like the effects that AIDS has on the supply of labor; economic problems, like the inability to pay for fertilizer; and biophysical problems, such as the depletion of P in the soil. My biggest reward for going to Kenya is knowing that I have in at least some small way helped advance research that is reducing world hunger and fighting poverty. I have seen the researcher’s wasteland, and I too know hope survives there.

Works Cited

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