Addis Ababa University

Thematic Research Prospectus

November 2020

Preamble

Message from the President

Message from the Vice President for Research and Technology Transfer (VPRTT)

Message from the Research Director

TABLE OF CONTENTS

COLLEGE OF DEVELOPMENT STUDIES

Inclusive Rural Urban Linkages in Ethiopia: An investigation into food systems, labor market, migration and peri-urban development

Executive Summary

The traditional way of thinking urban and rural as distinct entities in the economy misses the opportunities that could be derived from the interdependence between the two entities. As argued by the World Bank, ignoring rural–urban linkages leads to inefficiencies and causes growth-inhibiting inequality. As a result, several organizations and authors emphasize the role and importance of rural-urban interdependence and partnership for economic development and poverty reduction. Recently, the Sustainable Development Goals (SDG) have also entered a phase of emphasizing such linkages. One of the SDG's 11 targets focuses on the need to 'support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

Rural-urban linkages refer to sets of flows of capital (public and private), people (migration and commuting) and goods (trade) between rural and urban areas. The flow of ideas, innovation and information can also be considered one form of rural-urban linkage as can flows of water, biomass products, and nutrients between rural and urban areas. These sets of flows tie together the food system, labor market and migration patterns in a region and locality and have implications for residents' livelihoods. In addition, the boundary effects of urban expansion influence peri-urban development with enormous consequences on land use and livelihoods of the surrounding people. These dimensions of

the rural-urban linkage need to be understood since a viable path to ensure sustainable and inclusive development is to strengthen these linkages. The approach, however, largely remains unexplored or not taken to scale with the exception of a few cases.

In rural Ethiopia, though the smallholder agriculture is believed to be an important source of growth, it cannot be sustainable due to the problems faced by the small size of the domestic market for local demand, the low pace of urbanization and the weaknesses of urban-rural relations. The assumption that agriculture could take a leading role in economic development without concomitant strategy of urban development is questionable. On the other hand, urban development in Ethiopia is constrained by lack of functional integration with the rural hinterland. The urban sector in Ethiopia is characterized by weak linkages with the agricultural sector and the surrounding economic activities as most towns lack functional integration to the surrounding regions. This exacerbates food insecurity and poverty in urban areas and reduces the sustainability of urbanization. Urbanization policy envisaged in the country should thus be able to foster such linkages and address the problems of both the rural and urban sector.

This study aims at understanding the different dimensions of rural-urban linkages that can ensure sustainable and inclusive development and bring about integrated rural and urban development. The study focuses on unraveling the nature and scale of rural-urban linkages in food systems, labor market, migration and peri-urban development and the underlying effects on livelihoods. These dimensions of rural-urban linkages are characterized by flows of agricultural goods, labor, and urban expansion. In addition, factors that can support or discourage linkages in different settings will also be explored.

There are four sub-thematic areas in this research program. These are rural-urban linkages and food systems, rural-urban linkages and labor market, rural-urban linkages and migration and rural-urban linkages and peri-urban development. Though each of the four sub-theme has its own methodology of collecting and analyzing data, the study in general employs surveys and case studies as study approaches. Sample towns are selected from different farming systems (cereal growing, coffee growing, Enset growing, pastoral and agro-pastoral areas). In each study site, two towns (one small and one intermediate) will be selected purposively. Primary data will be gathered from rural households, urban households, enterprises and local governments. In selecting rural and urban households and enterprises, random sampling will be used after households and enterprises are stratified. Semi-structured interviews will also be carried with experts, residents and local government authorities to detect changes in rural urban areas.

The overall study will synthesize the findings from the different dimensions of rural-urban linkages and provide policy options for inclusive development in Ethiopia on the basis of rural-urban interdependence. As a follow up, the project team would prepare pilot project documents including rural-urban partnership models and seek additional funds for their implementation.

Principal Investigator: Prof. Tegegne Gebre-Egziabher

Members:

1. Muladam Alemu
2. Getahun Fenta
3. Esubalew Abate
4. Molla Maru
5. Samuel Minassie
6. Kassahun Gashu

The Dynamics of Population Mobility and the Implications in Ethiopia

Executive Summary

Population mobility, alias movement or migration is the movement of people from one place to another with intentions to settle in a new location either temporarily or permanently. It is also termed now and then as migration or the movement of people. It is duly referred to by the demographers as the basic concept of the mechanical movement of population. It is also a dynamic form of spatial mobility from a permanent habitat to the destination which means a new hub of residence. Movement or migration can have significant economic, cultural and demographic consequences. It is, in fact, one of the most important dynamic social processes.

The mobility can either be internal made within the borders of the country or international across states' boundaries. The movement of people could involve chaotic events and peaceful processes due to several reasons. Although it is difficult to understand or even speculate all factors behind population movements, it is however possible to chart some basic ones.

Some Basic Factors behind Population Mobility:-

In human history, ecological and social calamities can be triggered by the two major driving factors for peoples to move from one place to another. The former affects human environment due to natural factors such as earthquake, over flooding, drought and famine. They could finally generate movement due to forced displacement. Such natural disasters could deteriorate human wellbeing and force them quit their original settlements by exposing them to economic and social misery. Globally speaking, climate changes due to rapid shifts of

temperature and humidity generated failure to relying on crop cultivation or the declining of herbs in areas people were engaging in livestock herding. Human-made social calamities such as conflicts and large scale warfare could also lead to absence of social security, low productivity and eventually worsening food quantity and quality as well as deteriorating health conditions. Such exposure to different human-made calamities could force people to move to somewhere. Such instances could help students of population studies as a whole to understand the directions of environments and geographical setting to which people could eventually move. There are several parts of the world affected in the course of history due to high pressure of people's mobility. What is of high interest is that people can move anytime to anywhere both under adverse and peaceful or normal circumstances. In the latter case, it can be stated that there can be voluntary mass movements in search of better places for settlement or simply as a matter of discovering new places for settlement. Therefore, people do not always move due to social force or natural calamities.

Ethiopian Experience:-

The Ethiopian case is one of such areas of the world duly proofing as the platform of both types of social mobility. This seems to have led to the impermanency of several political centers and institutions of the country in both time and space perspectives. To put it in another way, Ethiopia has always been a platform of social mobility and its history can be safely argued as a history of movements of its diverse peoples within its own wider territorial setting. We may not have sufficient records to state all about population migration or movements in Ethiopia, to for instance, analyze and understand the details and levels of such dynamic activities. However, ever since its appearance on the annals of history, the Ethiopian region has always been the

melting pot of either temporal and permanent internal migrations or movements. This has also been a dominant and characteristic truth of both the Ethiopian polity and its society over centuries. This topic can be treated in its full picture if the research approach is quite thematic. There are many basic reasons for studying population movements. One is the advancement of sciences in its many branches to find out what happens in a given country like Ethiopia itself.

The dynamics of population movements can be or should be managed via the chart of interrelations with different disciplines in social sciences and humanities. The wider arena in real sense is most valuable if agronomy, economic geography, history, social anthropology, sociology and sociolinguistics jointly do justice of research on it. This is so if they are simultaneously treating to produce basic knowledge of multiple aspects with matters related to why peoples move from one place to another. Finally, this thematic research is a critical look into population mobility across time and space. Historical analysis forms its first component in order to clearly formulate past pictures over millennia of Ethiopian history. The sociological and anthropological component will treat changes and continuities in the mobility dynamics; and, one of also exploring various socio-cultural realities embodied in such movements of small and large scale natures. How population movements or migrations and the resultant interactions influenced linguistic performances of peoples and language shifts will be the task to be treated in this component. This component will deal with socio-linguistic dimension of population movements of long standing interactions in Ethiopia. The lower time bracket to handle historical developments in the course of peoples' motilities in Ethiopia will be the distant past as far as evidences go. Then, will follow the dynamics of migrations or movements in the course of the country's long history. The final is coming to the present dynamics to properly design our analysis and evaluation

to determine current realities and project future trends

Principal Investigator: Dr. Ahmed Hasen

Members:

1. Dr. Zelalem Teferra
2. Dr. Desalegn Amsalu
3. Dr. Takele Merid
4. Dr. Teferi Mekonnen
5. Dr. Abdussemed Haji Ahmed
6. Ato Nuredin Aman
7. Ato Aklilu Yilma
8. Dr. Girma Mengistu
9. W/ro Tirsit Sahle Dengel

COLLEGE OF EDUCATION & BEHAVIORAL STUDIES

Quality and Relevance of Management Education and Research in Ethiopia

Executive Summary

In this modern day competitive business environment, management education and research should catch up with the requirements of the day in terms of responding to evolving industry trends as well as coping up with technological changes. For example, the expansion of industrial parks all over the country necessitates having the required managerial competences that can accommodate both local and international management practices. There is always a need for the integration of local and international management knowledge and practices. Hence, this calls for enacting appropriate management education and research programs in the management/business schools of the country. In other words, our universities need to reinforce and sharpen their management education (and research) programs to prepare successful business leaders. This calls for more focus and attention on core management education and research areas: international business, Corporate Social Responsibility (CSR), Leadership and IT Governance. On top of this, Management education and research is in a nascent stage in Africa and more specifically in Ethiopia. The following section highlights each of the core areas of management education and research that this study will explore.

One of the sub-thematic areas is the quality and relevance of international business (IB) in management education and research in Ethiopia. This is because the export performance of Ethiopia in 2017 amounted to USD 2.86 billion and the import during the same year was USD 14.7 billion with a trade deficit

of USD 11.84 billion. Furthermore, what was anticipated in Ethiopia's second Growth and Transformation Plan (GTP II) is increased level of merchandise exports in the economy. However, comparing current export with expected export level, the picture is dismal. In one seminal study, IB competencies of firms are found to have positive relationship with export performance. This means that we need to evaluate the quality of research in IB to improve the export performance of Ethiopia. In regard to IB education, several studies have found a correlation between international business education and firm performance. This clearly indicates to us that on a firm level, we need to evaluate the quality and relevance of IB education in the Ethiopian context. Therefore, the aim of this study is to examine the status of the quality and relevance of international business management research and education

The second core area that the study will investigate is CSR education and research in Ethiopia. While CSR is better established in the developed part of the world, there is a burgeoning interest in CSR in developing countries, and yet there is no systematic review/study regarding the nature of CSR in the developing world including the status of CSR in management education in the universities of the developing countries. Likewise, CSR is a contemporary phenomenon in Ethiopia, and the area has not been broadly explored especially from the view point of the status of CSR in management education and research in the country's business schools/universities. Accordingly, this proposed study aspires to explore the extent to which CSR is taught and research is conducted in this field in management schools in Ethiopia.

The third sub-thematic area is leadership development, education and research in Ethiopian Higher education and industry context. It is widely recognized that leadership plays a

crucial role in solving multi-faceted problems of the developing countries. Cognizant of this, many higher education institutions have opened education and training program in leadership area, MBA, and EMBA with the objective of creating competent strategic leaders. There are almost no studies found to have investigated the effectiveness of leadership development, education and research practices in Ethiopian context. The proposed research will have three overarching aims including: assessing the quality and relevance of leadership education and research in Ethiopian Higher education institutions, assessing the effectiveness of leadership development practices in Ethiopian commercial and civic organizations and assessing the challenges in leadership development practices and research in Ethiopian commercial and civic organizations.

Finally, the last core area to examine is IT governance education and research in Ethiopia. With the development of digital service delivery, interactions, and platform economy, IT deserves more attention by CEOs and board of directors. This prompts for the design and development of IT governance strategies and frameworks. But, close observation about IT governance practices of organizations in developing countries like Ethiopia reveal that, this issue has not received the attention it deserves. Board of directors and CEOs do not consider IT governance under their domain of oversight and even they do not discuss on IT issues during their board meetings. Thus, to understand the source of such wrong perception, this study intends to analyze both the research and education practices on the topic. For example, educators from computing disciplines like computer science and software engineering focus on technical artifact development (both in teaching and research), while management courses appear to be distant from focusing on IT related issues. This made IT governance and related issues unnoticed by educators, researchers, and hence by managers. In brief, this proposed research will investigate the status of

management education and research in Ethiopia by focusing on the four core areas of the field – IB, CSR, Leadership and IT.

Principal Investigator: Dr. Mesfin Fikere

Members:

1. Dr. Yohannes Workaferahu
2. Ethiopia Legesse (D.Sc.)
3. Jemal Mohammed (PhD)

Student Engagement, Instructional Methods, and Student Assessment in Public Universities in Ethiopia: Practices, Gaps and Interventions

Executive Summary

Teaching-learning is one of the three pillars of university education (along with research and community service) in Ethiopia. Top among factors that determine the quality of the teaching-learning process in higher education are student engagement, instructional methods and student assessment. While the three factors are independently important in improving quality of education in general and student achievement in particular, they are also interrelated to each other and improving one is associated with or calls for improving the other variable. For example, engaging students in their learning requires instructional methods that are innovative and appealing to students. These instructional methods are active learning strategies in which the student is at the center of the teaching-learning process. To make both student engagement and instructional methods more effective, the use of continuous assessment using a variety of methods is necessary.

These assessment techniques would help teachers to provide timely feedback to students. Feedback helps students not only to know their results but also to make them aware of their strengths and weaknesses. This in turn helps students to find out ways of building on their strengths and working on their weaknesses. In other words, a good assessment strategy followed by feedback helps to engage students in their learning. In addition, student assessment could help teachers evaluate the effectiveness of the instructional methods they use and identify ways of improving them when necessary. Improving instructional methods also improves student engagement and hence academic achievement. On the whole, student engagement, instructional methods and student assessment are three factors that have special place in the teaching-learning process.

Principal Investigator: Dr. Fantahun Admas

Members

1. Dr. Abebaw Minaye
2. Dr. Feseha Teklu
3. Dr. Yekoyealem Dessie
4. Dr. Tamerie Andulaem
5. Dr. Mitiku Hambissa
6. Dr. Kassahun Habtamu
7. Dr. Seleshi Zeleke
8. Taglo Tarko

Effective Teaching-Learning of Science and Mathematics in Middle Schools at Addis Ababa City Administration, Amhara Region and Southern Nations, Nationalities and Peoples Region (SNNPR)

Executive Summary

In recognition of the correlation between effective teaching and student achievement, enhancing the skills and knowledge of the education workforce is a key priority. A major goal of parents and teachers is to produce educated and concerned citizens, and scientific literacy is a critical component of this endeavor.

Effective professional learning focuses on developing the core attributes of an effective teacher. It enhances teachers' understanding of the content they teach and equips them with a range of strategies that enable their students to learn that content. It is directed towards providing teachers with the skills to teach and assess for deep understanding and to develop students' metacognitive skills. An effective standards-based science curriculum provides an excellent and equitable science education for all students and provides for a deep understanding of essential science concepts.

Therefore, this thematic research titled "Effective Teaching-Learning of Science and Mathematics in the Middle Schools of in Ethiopia" is subdivided in to three sub-themes. The first sub-thematic research that enhances effective teaching-learning of science and mathematics is conceptual understanding through visualization techniques. Science teaching has always used and tried to visualize physical phenomena using visualization techniques as concept map, demonstrations, simulations, models, graphs, films, pictures, animations, real-life applications, experimentations, videos and multiple

representations can help students' understanding of concepts and phenomena.

The second sub-thematic research that enhances the effective teaching-learning of science and mathematics is by reasoning and problem solving. In order to solve routine and non-routine problems, conceptual understanding and reasoning are crucial. Good reasoning and problem-solving skills empower students in their educational, professional and personal lives. Nationally and internationally, there is a growing recognition that if education is to produce skilled thinkers, reasoners and innovators in a fast-changing global economy, then reasoning and problem-solving skills in the learning context are more important than ever. The ability to reason and solve problems in a range of learning contexts is essential for the development of knowledge, understanding and performance.

The third sub-thematic research for effective teaching-learning of science and mathematics are assessment techniques and active learning methods. Assessment techniques and active learning methods are important to enhance the conceptual understanding using visualization techniques, and reasoning and problem-solving skills. In visualization, reasoning and problem-solving techniques, students have to be active rather than simply passive recipients of information from the teacher, computer, textbook or any other source of information in the learning process because meaning is constructed in students' minds when they are actively processing information according to learning contexts. Involvement may be through a wide range of teaching and learning activities such as inquiry-based teaching, co-operative learning, questioning, discussions, field trips, role play and so on. In such learning situations, teachers also give emphasis to the importance of continuous formative assessment of students' understanding and providing detailed performance feedback in terms of improving students' understanding and

learning. To this end, this thematic research anticipates to assess current practices, intervene effective teaching-learning models and investigate the effect of the intervention on students' conceptual understanding, reasoning, problem-solving, attitude and academic achievement

Principal Investigator: Dr. Mulugeta Atenafu

Me**mbers:**

1. Dr. Shimelis Assefa
2. Dr. Kassa Michael
3. Dr. Solomon Belay
4. Dr. Mekbib Alemu
5. Ato Challa Regassa
6. Ato Abera Abate
7. Ato Habtamu Wodaj
8. Dr. Yekoyealem Desie

Teachers' Professional Identity in Ethiopia: Focus on the General Education

Executive Summary

Teachers' professional identity has recently become the interest of educational researchers as a way to understand and promote the "professionalization" of teaching. In a rapidly transforming global society, teachers, regardless of the country in which they work, are experimenting with their roles and recreating their professional identities in relation to the contexts that surround them, contexts that are shifting, sometimes in unexpected ways. Professional identity in the teaching context depends on three-pronged main characteristics: (a) expertise in one's area of

specialization, (b) moral integrity, and (c) expertise in didactical terms.

Teachers' professional identity has a substantial influence on students' achievement. It is also a key driver which could affect how teachers teach, how they develop professionally and how they approach educational changes. Though the Ethiopian teacher education program has undergone series of reforms, such as BPR, BSC, etc., the reform programs could not result in fundamental changes in the teacher education system in general and the professional life and identity of teachers. Meanwhile, no comprehensive study has been undertaken so far concerning the formation of teachers' professional identity in the Ethiopian general education system; there is visible knowledge gap in this area. This thematic research proposal, therefore, is prepared to assess the professional identity of teachers in the general education of Ethiopia. In so doing, the study develops the professional identity of teachers who work in the general education system.

The three sub-thematic topics that make up the research on Ethiopian teachers' professional identity are Professional Identity of:

- Early Childhood Care and Education Teachers/Caregivers in Ethiopia;
- Primary School Teachers' Professional Identity in Ethiopia; and
- Professional Identity of Secondary School Teachers in Ethiopia.

The first sub-thematic research "Professional Identity of Early Childhood Care and Education Teachers/Caregivers in Ethiopia," examines the professional identity of early childhood

care and education teachers/caregivers in Ethiopia covering private, government and faith-based centers across all the regions in the country. It also designs strategies to develop the professional identity of teachers/caregivers. Early childhood programs, by their very nature, focus on children's development and working on their readiness for starting primary education. Teacher's professional identity at this level is critically important from various angles. Most of all, it serves as a driving force to stay in the profession as well as to play an important role in the effective care and teaching of children at this level.

The second sub-thematic research is designed to explore the major issues, influencing factors and challenges related to the formation of teachers' professional identity in primary schools of the country. It is believed that the findings of this research would influence government policies and strategies related to the creation of improved professional identity of primary school teachers in the country.

The third sub-thematic research deals with the professional identity of secondary school teachers in Ethiopia. It provides a framework for secondary school teachers to construct their own ideas of 'how to be', 'how to act' and 'how to understand' their work and their place in society.

Principal Investigator: Dr. Daniel Desta

Members

1. Dr. Wossenu Yimam
2. Dr. Yekoyealem Dessie
3. Dr. Shimeles Assefa
4. Dr. Mulu Nega
5. Ato Anteneh Tefera

6. Dr. Belay Hagos
7. Dr. Berhanu Abera
8. Dr. Alemayehu T/Mariam
9. Abdinasir Ahmed Ibrahim (PhD)
10. Derebssa Dufera Serbessa (Prof)
11. Dr Desalegn Chalchisa

COLLEGE OF HEALTH SCIENCES

Cause-specific Mortality Burden of Communicable and Non communicable Diseases, and Injury in Adults and Major Causes of Neonatal and Child Mortality in Addis Ababa, Ethiopia

Executive Summary

Background: Ethiopia is suffering from triple burden of communicable and non-communicable diseases and injuries. Overall, 51% of deaths are attributed to non-communicable diseases, 42% to communicable diseases, and 6% to injuries. In addition, though Ethiopia has registered tremendous success in meeting Goal number 4 (reducing child mortality) of the Millennium Development Goals (MDGs), the decrease in neonatal mortality has not been as much as the decrease in post-neonatal and child mortality. In a country like Ethiopia where the majority of deaths are happening outside of health facilities, there is no adequate evidence on cause-specific deaths. Therefore, community based verbal autopsy (VA) method is an alternative source for estimating cause-specific mortality in a population.

Objective: To identify cause-specific mortality burden of communicable, non-communicable diseases and injury in adults and major causes of neonatal and child mortality in Addis Ababa, Ethiopia from 2018/2019 to 2021.

Methodology: All deaths at Addis Ababa will be registered from all burial cemeteries (from 73 existing cemeteries). We will randomly select 10% of all deaths to investigate cause-specific mortality using standard Verbal autopsy method. The

VA questionnaire forms comprise of neonatal, child and adult with a semi-structured interview guide. .Information about the deceased will be collected from deceased caregivers by house to house interview all over Addis Ababa. The probable causes of death as underlying, immediate and contributing factors will be assigned based on the WHO ICD-10 and VA code system. Statistical analysis will be conducted using STATA 12. In addition, social autopsy method will be integrated with verbal autopsy protocol to determine how social factors impact neonatal, and child deaths.

Principal Investigator: Dr. Bilal Shikur

Members:

1. Professor Damen H/mariam
2. Anteneh Belete
3. Abdurezak Ahmed
4. Amir Sultan
5. Tigist Bacha
6. Hayat Ahmed
7. Adane Pertros
8. Seifu Hagos
9. Abiy Seifu
10. Birtukan Seid
11. Tesion Afework
12. Wondimu ayele
13. Munir Awol
14. Yalemwork Getnet
15. Esete Habtemariam

Epidemiology and Molecular Characterization of Etiological Agents of Sexually Transmitted Diseases: Evaluation of Diagnostic Tools and Syndromic Approach in the Management of Sexually Transmitted Diseases in Ethiopia

Executive Summary

Sexually transmitted infections (STIs) are among the most common causes of illness in the world and have far reaching health, social and economic consequences. STIs have a great impact on health, potentially causing severe health outcomes like infertility, ectopic pregnancy, pelvic inflammatory disease (PID) and gynecologic cancers such as cervical, vulvar and vaginal cancers. STIs have public health importance because of their magnitude, potential complications and their interaction with HIV/AIDS. Sexually transmitted diseases (STDs) are thus a major public health problem in all countries, especially in developing countries, where access to adequate diagnostic and treatment facilities are very limited or non-existent. According to the WHO, each year there are approximately half a billion new cases of STDs worldwide.

There are a variety of clinical syndromes associated with STIs which are caused by bacterial, viral, parasitic, protozoan and fungal pathogens that can be acquired and transmitted through sexual activity. Bacteria such as *Neisseria gonorrhea* and *Chlamydiae trachomatis,* and viruses such as *Human Immuno Deficiency Virus* (HIV), *Human Papilloma Virus (HPV)* and *herpes simplex virus-2* (HSV2) are among the most common causes of STIs worldwide. A major worldwide problem in the management of STDs is the increase in drug resistance of the causative agents which makes it difficult to select proper treatments. Antimicrobial resistance of several sexually

transmitted pathogens particularly *Neisseria gonorrhea* and *Chlamydiae trachomatis* is increasing, rendering some regimens ineffective. For instance, almost all antibiotic classes used against gonorrhea lost their efficacy because of resistance, and the extended-spectrum cephalosporins (ESCs, i.e. cefixime and ceftriaxone), which represent the last remaining option for first-line empirical monotherapy, are also under threat, with resistance reported worldwide.

The diagnosis of STD in resource limited settings, like Ethiopia, is related to syndromic management approach (SMA) and based on the identification of a group of symptoms and easily recognized signs associated with infection and well-defined pathogens. The syndromic approach has been shown to be highly effective for the management of the majority of the STIs. Although the syndromic approach is effective in the management of STDs particularly in resource limited settings where diagnostic services are limited, it has several limitations such as inability to detect asymptomatic infections, over-treatment that may lead to development and expansion of drug resistance. In addition, many STIs have common symptoms, or are asymptomatic, and therefore undetected and untreated. All of these limitations of SMA affect patient diagnosis, the final outcomes of infection and hence reduce quality of cares. Furthermore, even among the few health facilities in Ethiopia that might use diagnosis through laboratory tests, light microscopy, serology and culture are the only most commonly diagnostic tools used to diagnose STIs. However, these techniques are usually time consuming and not reliable, and molecular methods are also rarely used for diagnosis of infectious pathogen for patient treatment in health care facility in Ethiopia. Therefore, prompt diagnosis and treatment of STDs by identifying their etiological agents and epidemiology and by determining their antimicrobial sensitivity and genomic characteristics using rapid, inexpensive, highly sensitive and

specific diagnostic tools are crucial for effective management and control of STDs mainly in developing countries like Ethiopia.

Principal Investigator: Dr. Woldearagay Ereku

Members:

1. Dr. Adane Mihret
2. Dr. Solomon Gebreselassie
3. Dr. Mahlet Yigeremu
4. Muluken Birhanu
5. Zelalem Desalegn
6. Yonas Alem
7. MeronYohannes
8. Professor Fikre Enkuselassie
9. BrhanuTeka
10. Muluneh Ademe

Epidemiology of Drug Resistant Tuberculosis, Determinants of Intervention Outcomes and Efficacy of Alternative Intervention Approaches in Ethiopian Community

Executive Summary

Introduction: Tuberculosis (TB) remains to be a major global health problem, responsible for ill health among millions of people each year. Ethiopia is one of the 30 high burden countries of TB, MDR-TB, and TB-HIV. Despite improvements in TB treatment outcomes, still a large proportion of poor treatment outcome has been documented; this is especially high for Drug Resistant TB patients. However, there is no well-studied information documented on the epidemiology of Drug Resistant (DR) TB, factors underlying low case detection, determents and

treatment outcome particularly in Ethiopian pastoralist community.

Tuberculosis control in urban settings is a huge challenge. Cities become important hubs for transmission of infectious diseases and have higher rates of tuberculosis infection. Literature sources have shown that established important risk factors vary from region to region. This indicates somewhat different foci for preventive interventions in different regions based on the estimation of important social determinants and risk factors.
TB and nutrition have bidirectional relationship in which having active TB leads to loss of weight, and being underweight is considered a risk factor for developing TB. Remaining undernourished during TB treatment has a higher risk of relapse and poor treatment outcomes. For poor and food-insecure individuals, accessing and successfully completing anti-tuberculosis treatment over an extended period of time is challenging for TB control program. Therefore, willingly identified proxy markers of unsuccessful TB treatment outcomes are needed for early intervention.

Hence, the current practices need the integration of nutritional intervention in the TB treatment services by strengthening the links between nutritional intervention and specific service using mobile technology. In line with international and national target to reduce the burden of TB, there is need for evidences in our country regarding context specific epidemiology of the disease, factors underlying low achievements in the intervention activities and effective alternative approaches.

Goal: The major goal of this study is to assess the epidemiology of tuberculosis in Ethiopia, with focus on assessing prevalence of drug resistance TB in pastoralist community, identify social and nutritional determinants of interventions outcomes, and pilot an intervention to improve TB treatment outcome. We aim to

study challenges across the continuum of tuberculosis control program from determinants of case identification to that of intervention outcomes and from urban to rural pastoralist community settings.

Methods- Mixed methods of study designs will be used to address the stated goal. To assess the prevalence and factors associated with drug resistant TB institution-based cross sectional study design will be employed. To assess factors underlying low TB case detection in the pastoralist community, exploratory qualitative study will be conducted. To determine drug resistant tuberculosis treatment outcome and its determinants, retrospective cohort study design will be used. In the cohort study, previous anti-tuberculosis treatment will be the main exposure variable assessed for its effect on the treatment outcome. Prospective cohort study design will be employed to assess the treatment outcomes and its determinants among TB patients? and to analyze the treatment outcome variation by nutritional status and social determinants. Community-based interventional design will be used to assess the effect of community health workers training using the national community-based TB care guideline. Case control study design will be employed to assess social determinants on risk of tuberculosis and delay in test seeking behavior in the slums of Addis Ababa.

Cluster Randomized Trail (CRT) study design will be employed to assess the effect of mobile health SMS text messaging intervention on nutritional status as a primary outcome of the research objective and treatment outcomes of TB patients as a secondary outcome of the research objective.

Sample size is calculated for each specific objective in accordance with respective design used to achieve the objective

(indicated in the sub-themes). Commonly used assumptions for all quantitative statistical analysis for single and double population formula with statistical assumption 95% Confidence Interval, ($\alpha = 0.05$) and power of 80% ($\beta = 0.20$) will be used. In cluster sampled part average cluster size of 10 and inter-correlation coefficient (ICC) of 0.05, design effect of 1.5 considering 10% non-response rate, 10% loss to follow-up, and assumption given to at least 90% of the patients will have personal mobile phone.

Different methods of data collection will be used for different parts of the study. Quantitative and qualitative data will be collected using validated tools, entered and analyzed using EPI Info, STATA/SPSS software applications. Descriptive statistics and multivariable analysis will be performed using binary logistic regression, and Cox regression models as appropriate to the data set for the study designs. Confidence level of 95% and significance level of 5% will be used to determine the significance level of association. Measure of effect such as odds ratio and hazard ratio will be reported depending on the design of the study. Association between categorical variables will be assessed using chi square test, and Independent-samples t-tests and Mann-Whitney tests will be used to compare means, medians respectively as appropriate. Generalized Estimating Equation (GEE) will be employed for the adjustment for the joint effects of cluster and individual level factors. Structural equation modelling will be employed to examine the mediating effect of the main social determinant variables and mechanisms among tuberculosis patients. The p**roject takes** three years and the estimated cost is **1,788,489.00** Ethiopian Birr,

Principal Investigator: Dr. Robel Tezera

Members:

1. Professor Ahmed Ali
2. Professor Damen Hailemariam
3. Professor Alemayehu Worku
4. Dr Negusse Deyessa
5. Professor Jemal Haidar
6. Dr. Seifu Hagos
7. Dr. Setargew Kenaw

Assessment of Vitamin D Level, Prevalence of Deficiency, Associated Health Consequences and Impact of Vitamin D Supplementation among Adult Population of Ethiopia

Executive Summary

Vitamin D is an essential micronutrient for bone and extra skeletal tissues. Vitamin D is obtained from food but its most important source is skin synthesis of vitamin D_3 upon exposure to ultraviolet B radiation (UVB). In the liver, vitamin D_3 is converted to 25-hydroxyvitamin D [25(OH)D] which is the universally recognized measure of an individual's vitamin D status. The normal 25(OH)D range is controversial, but many experts recommend 30-60 ng/ml. be considered optimal. A primary function of vitamin D is regulation of calcium and phosphorus absorption from bone and intestine to maintain blood calcium and phosphorus levels and promote bone mineralization. Thus, vitamin D deficiency in children causes rickets; a skeletal deformity and in adults osteomalacia and osteoporosis characterized by decreased bone mineral (calcium) content that increases risk of fractures. In addition to bone effects, many studies document an important role of vitamin D in the regulation of cell growth and hence prevention of cancer. Higher vitamin D levels are associated with reduced cancer incidence and decreased cancer related mortality. Vitamin D has

also effects on the immune system and may also be important in infection control, blood pressure regulation, cardiovascular diseases, development of diabetes mellitus, multiple sclerosis, rheumatoid arthritis and other autoimmune conditions.
Consistent risk factors for vitamin D deficiency include extremes of age, female sex, nutritional status, latitude, obesity, skin pigmentation, sun protection, covered clothing style and seasonal variation. Furthermore, the liver and kidney play an essential role in the synthesis of vitamin D and diseases affecting these organs can lead to vitamin D deficiency.

Vitamin D inadequacy affects both the developing world and developed countries. Indeed, vitamin D inadequacy is a common disorder across all age groups worldwide. Importantly, vitamin D deficiency is common in a number of developing countries despite the fact that many of these countries lie in zones that have sufficient sunlight for vitamin D synthesis. For example, vitamin D inadequacy is highly prevalent in China, Mongolia, India, Sub-Saharan Africa, the Middle East and Latin America.

In view of the potential importance noted above, assessment of vitamin D status across a population in a country is important to establish base line vitamin D data and also to reveal if deficiency exists. If hypovitaminosis D is common, as it is linked to major chronic diseases, intervention strategies must be planned to correct such a deficiency.

No data exist defining the vitamin D status of Ethiopian population. The objective of the first sub-thematic research is to establish the vitamin D status among adult Ethiopians in three ecological zones covering highland, midland and lowland. Ecological zones are purposefully selected since the altitude is an important factor strongly and significantly associated with Vitamin D status. A survey questionnaire will be employed to collect data regarding demographic, socioeconomic, dietary, and

clothing characteristics of study participants. Health related questions will also be included in the survey.

Principal Investigator: Prof. Yewoinhareg Feleke

Members:

1. Dr. Wubegzier Mekonen
2. Dr. Biruk Lambisso
3. Dr. TewabechZewde
4. Dr. Jemal Haider
5. Dr. Bilal Shikur
6. Dr. Nardos Worku
7. Dr. Ananya Kassahun
8. Dr. Mahder Eshete
9. Feyessa Challa
10. Dr. Getahun Tarekegne
11. Tekalegn Damena
12. Yemisrach Tekele

Studies on the Impact of Water Resource Development and Climate Changes on Major Vector-borne Parasitic Diseases in Selected Areas in Ethiopia

Executive Summary

This thematic research (TR) comprises three sub-thematic researches (STRs). The three STRs are STR I that involves investigation of impact of irrigation schemes and climate on malaria transmission in Ethiopia, STR II dealing with investigation of impact of irrigation schemes and climate variability on the transmission of visceral leishmaniasis in

Shebelle Zone, Eastern Ethiopia and STR III that focuses on the study on the impact of water resource development and climate change on schistosomiasis and other snail-transmitted trematodiases in selected areas in Ethiopia. The proposed thematic research is within the Addis Ababa University research priority which is also in line with the national health research priority. It is highly relevant and significant as it addresses three vector-borne diseases (malaria, leishmaniasis, and schistosomiasis) of public health and socio- economic importance in Ethiopia. Over 75% of the total landmass of Ethiopia is malarious, making malaria the leading public health problem in the country. It affects millions of people, causing thousands of deaths every year. Although the actual number of people affected by cutaneous and visceral leishmaniasis is not known at country level, the annual burden of the visceral form, which causes deadly disease, is estimated to be between 3,700 to 7,400 cases with more than 3.2 million people being at risk. Human schistosomiasis due to intestinal and urinary forms affects over 5 million people and put an estimated 38 million people at risk. The present study also addresses livestock diseases caused by *Fasciola* species and *Schistosoma bovis* that have similar transmission ecologies with human schistosomes, all of which are transmitted by different snail species.

Despite intervention measures put in place by the FMoH to control malaria, schistosomiasis and leishmaniasis (case treatment only), they all still represent public health problems. Water resource development and climatic variability are among the major factors that contribute to transmission of these diseases. Ethiopia has embarked upon water resource development projects, mainly for irrigation and hydropower in order to increase food production and for socio-economic development. Although such endeavors have positive socio-economic impact, they are also accompanied by unintended impacts on human and animal health. Ecological changes

brought about by water resource development including construction of irrigation schemes, reservoirs and dams for agricultural purposes and hydroelectric power have long been associated with increased incidence of water- related parasitic diseases of humans and animals. Climatic changes, which are also mainly of anthropogenic in origin, affect the equilibrium of ecosystems and the distribution of species they sustain through creation of favorable breeding grounds for malaria, filariasis, etc. vectors and snail intermediate hosts of schistosomes and other trematodes. Besides their direct impact on alterations of the geographic areas, both water resource development and climate variability have indirect impact on water-related diseases through impact on human migration patterns that affect disease distribution. The proposed research will be implemented in Koga irrigation schemes in northwestern, Gibe dam areas in southwestern and Shebelle Zone in eastern Ethiopia. The overall objective of the proposed thematic research is to investigate the impact of water resource development projects (irrigation scheme and hydroelectric power dams) and climatic variability (temperature, rainfall, humidity) on transmission of malaria, leishmaniasis and schistosomiasis together with their vectors/intermediate hosts. To achieve its objectives, the project uses various approaches including collection and microscopic examination of blood and faecal specimens, entomological methods (larval and adult mosquitoes and sandfly species collection), and malacological methods (snail collection, identification, cercarial shedding, mice/hamster infection). In addition to climatic data (temperature, humidity, rainfall) to be obtained from National Meteorological Service, the project teams record same variables for three years during fieldwork. All the data will be analyzed using appropriate statistical approaches.

The project is a collaborative project involving experts from

various disciplines, universities, ministries of Health and Agriculture. Over 9 PhD and MSc students will be attached to the proposed projects and the findings are expected to help policy makers in designing disease control measures towards their local elimination.

Principal Investigator: Dr. Sisay Dugassa

Members:

1. Abebe Animut
2. Araya G/Selassie
3. Yohannes Negash
4. Solomon Yared
5. Berhanu Erko
6. Tesfu Kassa
7. Tadesse Eguale
8. Tadesse Kebede
9. Zerihun Mekonnen

Diarrheal Diseases in Selected Sites of Ethiopia: burden, management practices, major etiologies and antimicrobial susceptibility of bacterial pathogens

Executive Summary

Diarrheal diseases constitute one of the most important causes of morbidity and mortality all over the world. Relative contribution of pathogens varies depending on the age of the patient, geographic location and other factors. There is lack of sufficient data on the burden, management practices and relative contribution of the major pathogens causing acute diarrheal diseases in low and middle-income countries like Ethiopia. Management of diarrhea is difficult due to

overlapping clinical syndromes of diarrhea and the scarcity of laboratory based proper diagnostic tools to correctly identify the various causative agents. Understanding the magnitude and the overall burden of diarrheal diseases, major etiologies involved and antimicrobial susceptibility of diarrhea causing bacteria in a given study area is essential to design appropriate control interventions/strategies. This thematic research proposal deals with three STRs which is planned to be conducted in 3 different localities: Addis Ababa representing highly populated metropolitan city, Debrebrhan area from North Shoa Zone of Amhara region representing highland area, and Amibara district of Afar region representing lowland area of the country. Sub-thematic research (STR) I aims to investigate the burden of diarrhea in selected health facilities and at the community level in the study area and the common management practices. Sub-thematic research (STR) II deals with assessment of relative contribution of various etiologies of diarrhea using conventional tools and molecular techniques in selected study localities. Sub-thematic research (STR) III deals with determination of antimicrobial susceptibility of bacterial isolates and genetic markers associated with resistance in isolates obtained from diarrheic patients in selected study localities. Burden and management of diarrhea will be studied using communities and health facility based cross-sectional study design in selected study areas. Stool samples from diarrheic patients will be investigated using standard microbiology techniques and microscopy. DNA from stool sample of diarrheic and matched non-diarrheic individuals will be extracted and investigated using multiplex PCR based on the previously designed primer sets for major bacterial, viral and protozoal pathogens. We will then analyze the rate of association of detection of various pathogens with diarrhea. Antimicrobial susceptibility status of bacterial isolates and genetic markers associated with resistance will also be studied

on isolated diarrheogenic bacterial species isolated from patients in study localities. Appropriate recommendations on management of acute diarrhea will be made based on the findings of the study. In general, this thematic project will estimate the burden and level of problems associated with management practices of diarrhea-like diagnosis and irrational prescription of antimicrobials. It will also generate relative rate of contribution of various bacterial, viral and protozoan pathogens to diarrheal diseases in specific study localities and associated risk factors for occurrence of diarrhea will also be investigated. Moreover, antimicrobial susceptibility status of bacterial isolates causing diarrhea and associated genetic markers in the study area will also be established. This thematic project also aims at building human capacity in identification and characterization of major diarrhea causing pathogens by training at least 3 PhD and 6 MSc students. Additional funding will be solicited from national and international collaborating institutions to build laboratory facility and for molecular analysis. This thematic research is proposed to be conducted in collaboration with appropriate and interested National and international institutes/universities.

Principal Investigator: Dr. Tadesse Eguale

Members:

1. Dr. Mengistu Legesse
2. Dr. Adane Mihret
3. Dr. Nega Berehe
4. Dr. Daniel Asrat
5. Dr. Haile Alemayehu
6. Prof. Berhanu Erko
7. Dr. Girmay Medehin
8. Dr. Wudu Mehret

Effects of Women's Empowerment and Intimate Partner Violence on Pregnancy, Neonatal and Nutrition Outcomes, and Challenges and Consequences of Feeding Practice on Maternal and Child Health

Executive Summary

Background: Maternal and child health is the priority concern for global health. Both mothers and children are vulnerable/disadvantaged population group who can be easily affected by exposures or hazards. Since mothers and children encompass the majority of population portion, addressing the health need of these groups will indirectly address the general population. Intimate partner violence among pregnant mothers, maternal and child nutrition and women empowerment for health of mothers would be the focus area of this thematic research project.

Gender based violence against women is the most pervasive and the least addressed human rights violation. It is an important global public health problem, with significant health and socioeconomic development consequences. It may occur at any stage of a woman's life including during pregnancy. Particularly, intimate partner violence against pregnant women is a universal problem with higher prevalence reported in developing countries. It is regarded as an important risk factor for adverse health outcomes for women and their offspring.

Adequate nutrition is essential for human beings which is extraordinarily crucial for pregnant mothers, lactating mothers and children. It is an indicator for children's health and development. Even though national and international efforts are undergoing, still the problem of malnutrition is significant both among mothers and children. Under-nutrition kills or disables

millions of children every year, and prevents millions more from reaching their full intellectual and productive potential. The causes of maternal and child under-nutrition are multiple problems that are inextricably linked to poverty.

Inadequate and excessive gestational weight gains have been linked with higher risk of adverse maternal and infant outcomes. On the other hand, in addition to being an end goal in itself, women's empowerment is considered a means to achieve improvements in maternal nutritional status and pregnancy outcomes.

Goal: The main goal of this thematic research is to assess the effects of women's empowerment and intimate partner violence during pregnancy on pregnancy, neonatal and nutrition outcomes, and consequences and challenges of feeding practices in the first two years of life in selected zones of Oromia and SNNP region, 2019.

Methods: Different study designs are employed to measure specific objectives. To measure prevalence and potential determinants of intimate partner violence against pregnant women, to determine status and determinant factors of maternal nutrition during lactation, to assess feeding practices and challenges during the age of 0 to 6 months, and to assess child nutrition practices and associated factors are going to be conducted with cross-sectional study design. While, effects of intimate partner violence against pregnant women on maternal and neonatal outcomes and effect of women empowerment on dietary diversity among pregnant women would be conducted with prospective cohort study design. Quantitative and qualitative methods will be recruited. For the effect of intimate partner violence measure and to measure women's empowerment a total of 1523 and 1191 pregnant women would be recruited at the initial time in different areas respectively. To

measure the status and determinants of nutritional status during lactation, infancy and childhood, a total of 667 would be recruited.

Descriptive statistics and mixed-effect multilevel analysis will be employed. Data will be analyzed using Stata version 14.0. Different key informants would be interviewed and eligible pregnant mothers and lactating mothers would be discussants for focus group discussion. Data quality assurance would get the highest focus starting from collection to handling of the data.
Expected outcome: The effect of intimate partner violence, women's empowerment and other socio-economic characteristics on maternal and child health would be measured. This project is expected to produce three dissertation books and more than eleven articles/manuscripts. The project will be implemented over a three year period and the total estimated cost is 1,690,339.36 ETB.

Principal Investigator: Dr. Eshetu Girma

Members:

1. Prof. AlemayehuWorku (PhD)
2. Prof. Ahmed Ali (PhD)
3. Dr. Mitike Molla (PhD)
4. Dr. Solomon Shiferaw
5. Mr. Alemayehu Getahun
6. Mr. Mesfin Mamo
7. Mrs. Tizita Dengia
8. Mrs. Bezawit Ketema

Urinary Tract Infection among Pregnant Women and PLWH in Selected Health Sectors of Central Ethiopia: Prevalence, Causal Agents and Antibacterial Resistance with Molecular Detection of Genetic Markers Associated with Resistance

Executive Summary

Urinary tract infection is the most important public health problem among immune-compromised people specially, people living with HIV/AIDS, and pregnant women, caused by uropathogens like gram negative bacteria including *E. choli* , *Kelseilla* sp., *Citrobactor* sp. and gram positives like *Enterococcus*, *Staphylococcus* spp., etc. Even though the infection spreads globally, its burden is high in developing countries. Further, the antibacterial resistance to common bacterial uro-pathogens to third generation antibiotics is a fueling factor in the dissemination of the antibacterial resistant uro-pathogen to all age groups of the population. Studies are limited in identifying bacterial uro-pathogens causing UTI among pregnant women and people living with HIV/AIDS and determining its antibacterial resistance with its molecular detection of genetic markers associated with resistance. Understanding the magnitude of UTI among pregnant women and people living with HIV/AIDS and its antimicrobial resistance with its molecular characterization of genetic markers associated with resistance is important to design appropriate strategy to control UTI and its complications. Therefore, this study is aimed at determining the magnitude of UTI among pregnant women and people living with HIV/AIDS and its antibacterial resistance and its molecular characterization genetic markers associated with resistance pathogens. Institutional based descriptive cross-sectional study design will be employed on 841 selected pregnant women, and 496 PLWH study subjects from selected health institutions of each study city (Adama, Fitche and Addis Ababa) that will be selected by simple random sampling and stratified systematic random sampling methods from pregnant women, and people living with HIV/AIDS attending health care centers of the selected study cities. Clean-catch midstream urine samples will be collected from each client. The urine specimens will be collected into sterile containers and transported to the lab within 4 hrs of

collection. A loopful (0.001 mL) of well-mixed urine will be streaked on to MacConkey Agar and Blood Agar plates. Then, the plates will be incubated aerobically at 37˚C for 24 hrs, and counts will be expressed in colony forming units (CFU)/ml. A count of $\geq 10^5$ CFU/mL will be considered significant to indicate UTI. In addition, different selective media will be used to isolate various uro-pathogenic bacterial organisms and further identified using different biochemical tests. Granulocytes of past history of the study participants in the case of sub-thematic research (STR) I, urinary tract infection; urinary tract surgery; renal stone will be reviewed from recent information sheet of patients' chart while the rest of socio-demographic and clinical and background characteristics will be interviewed from the pregnant women, and PLWH. The collected data from the sample and interview of the participants will be verified, coded and entered into EPI data software version *3.1* and analyzed using SPSS version 22. Bivariate and multivariate analyses will be computed to see the possible association of factors with the dependent variables. Variables with p-values of less than 0.03 in multivariate analysis will be declared significant. Finally, the result will be described using descriptive statistics like mean, median, proportions and frequency using tables, graphs and texts.

In all-purpose, in addition to determining the extent of UTI among pregnant women and PLWH with isolation of possible UTI causing bacterial pathogens and their antimicrobial resistance and molecular characterization of strains resistant to antibacterial, this thematic project will help the investigators, MSc and/or PhD students, and other colleagues to collaborate with national and international collaborators through searching additional funds from national and international collaborating institutions to build laboratory facility and conduct molecular analysis. As a result, the thematic research is proposed to be

conducted in collaboration with appropriate and interested National and international institutes/universities.

Keywords: Antibacterial resistance, antibacterial sensitivity, PLWH, pregnant women, Uro-pathogen, UTI

Principal Investigator: Dr. Wondossen Amongne

Members:

1. Tadesse Eguale (PhD, Associate Professor
2. Girmay Medhin (PhD, Associate professor)
3. Ketema Bizuwork(MSc, Lecturer)
4. Haile Alemayehu (MSc, Assistant Professor)
5. Engida Yisma (PhD fellow, Assistant Professor,)
6. Erdaw Tachbele (PhD, Assistant Professor)
7. Tiruneh Ararsa
8. Kalkidan Wondwossen

Improving the Early Detection and Treatment Outcome of Colorectal Cancer by Introducing Virtual Colonoscopy/Non-invasive Imaging Method

Executive Summary

Colorectal cancer (CRC) is one of the leading causes of cancer and cancer-related mortality worldwide. The disease has been traditionally a major health problem in industrial countries, however the CRC rates are increasing in the developing countries that are undergoing economic growth. Several environmental risk factors, mainly changes in diet and life style, have been suggested to underlie the rise of CRC in these populations.

Imaging studies are frequently used to evaluate patients for screening and staging of colorectal cancer. Cross sectional imaging studies such as computed tomography colonography (CTC) / virtual colonoscopy, positron emission tomography (PET)/CT colonography and magnetic resonance imaging (MRI) provide anatomic and morphologic information about tumors and patterns of spread.

With the emergence of non–communicable diseases (NCD) in countries where traditionally the biggest problem was infections, it is estimated that, by 2030, cancer will become the cause of over 13 million deaths a year. (2) In recent years, the role of CTC as a potential alternative to endoscopy has been widely studied. If CTC is aimed at the sole examination of the colon (*e.g.*, for CRC screening purposes), the use of low radiation dose CT acquisition protocols is warranted. Conversely, regular dose CT protocols can be used if CTC is part of a CT examination in which all abdominal organs have to be investigated. (3) The main aims of this project include to assess the diagnostic performance and feasibility of virtual colonoscopy/ CT colonography and compare it with Optical endoscopy, determining the staging of CRC at the time of diagnosis, assessing the treatment outcome of CRC in oncologic and surgical treatment and evaluating the value of multidisciplinary team management of CRC.

Therefore, the project will have 4 sub-thematic areas to answer the overall objectives; which include screening symptomatic patients for CRC with CTC/virtual colonoscopy after optical colonoscopy blinded for the result of optical endoscopy. Determining the staging at the time of diagnosis using a recommended and standard cross-sectional imaging like high resolution pelvic MRI, CT scan of abdomen and pelvis and US, patients diagnosed with CRC through the project or those

referred from outside after diagnosis will be managed through the MDT and patients treatment outcome will be evaluated.

Mixed methodologies will be applied to address the different objectives including longitudinal observational cohort will be applied for assessment of treatment outcomes of CRC both for oncologic and surgical management of all patients enrolled for oncologic and surgical, a cross-sectional observational study will be applied to determine staging at the time of diagnosis all patients with CRC who undergo for the cross-sectional imaging through the project period will be enrolled and finally a comparative study will be made to assess the diagnostic performance of Virtual colonoscopy by comparing it with the existing standard diagnostic method, optical colonoscopy. The project will last for five years in order to assess the mortality and survival of the patients with CRC.

For successful implementation of the project, the already functioning MDT is a good ground which will be strengthened by involving more people, developing an institutional protocol, developing a database to catch and manage cases at the outpatient, endoscopy unit, radiology department, oncoclogy and surgical CRC clinics. Virtual colonoscopy application training will be given for Technologists and certifying training will be given for body imaging subspecialist radiologist. the required supplies will be purchased.

Principal Investigator: Dr. Asefa Getachew

Members

1. Dr. Tesfaye Kebede
2. Dr. Biniam Tefera
3. Dr. Wondim Getnet
4. Dr. Frehiwot Getahun

5. Dr. Mathios Assefa
6. Professor Berhanu Kutiso
7. Dr. Daniel Zemenfes
8. Dr. Mengistu Erkie
9. Dr Wondimagegn
10. Prof. Asfaw Atnafu

Epidemiology and Economic Burden of Non-communicable Diseases in Addis Ababa, Ethiopia

Executive Summary

Background: The epidemiological significance of non-communicable diseases (NCDs) is dramatically rising both in developed and developing countries. Currently, more than two-third of all deaths globally are caused by NCDs. In Ethiopia, limited information exists regarding the epidemiology of NCDs; consequently, prevention and control efforts lack both intensity and focus.

Objective: The general objective of the thematic research (TR) project is to assess the magnitude, change over time (2019-2021), risk factors and economic burden of NCDs in Addis Ababa city. The ultimate goal of the TR is to generate timely and persuasive evidence on the epidemiology of NCDs that would not otherwise be available through the existing Health Management Information System of the city. The generated information will be used by stakeholders to inform public health strategies, programs and practices.

Methods and materials: This TR, comprising six sub-thematic research (STR) projects, will be conducted by a multidisciplinary research team pooled from two different colleges of Addis Ababa University, School of Public Health of the College of Health Sciences and Center for Food Science and Nutrition of the College of Natural and Computational Sciences.

The research team will also involve the end-users of the data including delegates of the Addis Ababa Regional Health Bureau (RHB) and Ethiopian Public Health Institute (EPHI). The TR has six sub-thematic research projects grouped under the following three sub-components.

1. ***Community-based surveys***: In this, two large community-based surveys will be conducted in 2019 and 2021. This sub-component will generate the data required for four of the STRs. The surveys will measure and monitor the prevalence and determinants of the key risk factors of NCDs including hyperglycemia, hyperlipidemia, raised blood pressure, overweight/obesity, physical inactivity, high salt intake, low fruit and vegetable consumption, low fiber intake and alcohol and tobacco use. In each survey, around 1,500 eligible adult subjects will be selected from 32 kebeles of the city using multi-stage sampling approach. Data will be collected based on the World Health Organization "STEPwise" approach for NCD surveillance. Fasting blood glucose level and total cholesterol concentration will be determined from venous blood samples. Total calorie intake and percentage contribution of free-sugars and fats will be determined using a nested 24-hour dietary recall study. Blood pressure will be measured using digital blood pressure monitors. Pattern and determinants of the risk factors will be assessed using mixed effects regression models.

2. ***Economic burden analysis***: This sub-component is designed to estimate the economic burden associated with diabetes and hypertension in the city. Two health institution-based surveys specific to the two medical conditions will be conducted in 2020. The surveys will recruit 422 diabetic and 422 hypertensive patients on follow-up in 12 public hospitals and randomly selected 12 health centers found in the city. Patients will be recruited using quota sampling approach.

Cost to be estimated include, direct healthcare and non-healthcare costs and indirect costs.

3. ***Qualitative assessment of the multi-sectoral response to NCDs***: This qualitative undertaking is designed to appraise the comprehensiveness of NCD prevention and control efforts in the city. The study will be conducted in 2020 and it will evaluate the availability of supportive legal and policy framework, adequacy of the health sector and multi-sectoral response, and existence of enabling physical environment for combating NCDs. Data will be collected through policy analysis, desk reviews and key-informants interview. The data will be analyzed using content thematic analysis approach.

Outputs of the project: The proposed TR project will generate a large dataset capable of supporting ten MSc research projects. The findings of the TR will be disseminated to the scientific community through one comprehensive technical report, twelve journal articles and seven scientific conference presentations. Non-scientific audiences will be reached through developing two policy briefs and two press releases. At the end of the three years period, efforts will be made to upgrading the TR project to a full-fledged NCD surveillance system by securing external funding or by integrating it with the disease surveillance system of the EPHI or the RHB.

Budget: The study requires a total budget of 1,864,880ETB over the three-year period.

Principal Investigator: Dr. Samson G/Medihen

Members:

1. Dr. Adugnaw Berhane

2. Dr. Bilal Shikur
3. Dr. KaleabBaye
4. Dr. Seifu Hagos
5. Mr. Tilahun Bekele

Malignant Lymphoma in Ethiopians with Emphasis on High Grade and HIV Associated Lymphomas: Improved diagnosis and treatment

Executive Summary

The proposed project focuses on improving diagnostics and treatment of lymphomas by adding advanced immunological and molecular diagnostic techniques. In this project, we will study the impact of implementing these techniques in the Ethiopian setting. It is clear that advances in diagnostic techniques and personalized treatment protocols are urgently required in our setting for patients with hematologic malignancies. In this study, we will investigate how adding immunohistochemistry (IHC), flow cytometry, fluorescence in situ hybridization (FISH), and other molecular diagnostic techniques can be used to strengthen and improve treatment modalities. Improved diagnostics and classification of lymphomas using the "cell of origin" multimodality testing approach should in turn enable application of targeted therapies. The technology developed, in the Department of Pathology, through this study will in the future also be used to diagnose and treat other malignant diseases. Moreover the knowledge gained and the technology developed through this study can be shared with other institutes and hospitals in the country.

Principal Investigator: Dr. Senait Ashenafi

Members:

1. Amanuel Damie
2. Tufa Gemechu
3. Amha Gebermedhin
4. Fisehatsion Tadesse
5. Rawlige Howe
6. Prof. Mats Jerkeman
7. Daniel Tesfa
8. Monika Klimkowska

Breast Cancer in Ethiopia: Biology, Genetics and Innovation

Executive Summary

Breast cancer is the most common cancer in women globally. There is a rapidly growing burden of disease due to this malignancy in low- and middle-income countries (LMIC), where patients are young and present with late advanced disease. The purpose of this study is to build evidence and research capacity relating to breast cancer in Ethiopia. In this study qualitative methods will be used to better understand perceptions, needs and barriers to care among breast cancer patients, tumor biology will be studied to improve treatment options, genetic analysis will be used to identify breast cancer related genetic mutations and Artificial Intelligence (AI) will be tested as an option in tumor diagnostics.

By investigating the prevalence of mutations associated with in Ethiopia, as well as by examining its penetrance to their first-degree relatives, the study aims to show the importance of risk-based mammography screening in settings where population wide screening is hard to achieve. Moreover, by implementing Artificial Intelligence (AI) in the Department of Pathology this

study will also investigate the feasibility of using AI as a tool for pathology diagnostics in order to increase accessibility of pathology services in the country. This research has potential to lead to improved diagnostic and treatment as well as to cost effective method of prevention, in low income countries (LIC) where most breast cancer mortality occurs.

Principal Investigator: Dr. Tewodros Yalew

Members:

1. Senait Ashenafi
2. Yonas B.Tsion
3. Mathewos Assefa
4. Endale Anberber
5. Alemayehu Worku
6. Jenny Löfgren
7. Tove Ekdahl Hjelm

COLLEGE OF HUMANITIES, LANGUAGE STUDIES, JOURNALISM & COMMUNICATION

Description and Documentation of Languages and Cultures of the Me'en and Dizi Ethnolinguistic Communities

Executive Summary

Ethiopia is one of the multilingual and multicultural countries in the world where over 85 linguistic groups (nations, nationalities or peoples) live. Up to now, more than half of the languages have become implemented as the media of instruction and/or the languages of study. The other one third, however, are listed as endangered languages and need urgent documentation. Many of those languages which have already started enjoying formal function (such as schooling, mass media and administration) do not receive corpus planning. This proposal deals with the two languages spoken in Bench Maji Zone: the Me'en and Dizi languages. Me'en and Dizi languages are under the list of endangered Ethiopian languages. And this proposal is prepared with the major objective of assisting the documenting of the Me'en and Dizi languages and cultures for future linguistic research.

The languages and cultures of the two ethnic groups (Me'en and Dizi) in Bench Maji Zone are endangered. As it is well known, languages are the core bearers of social identity. Genuine socio-cultural values, norms and beliefs of a speech community are embedded in the community's language. Thus, not only the languages face extinction, but also the indigenous knowledge and the cultural heritage tied to these languages. A researcher underlined that language death is more often than not a social loss. It is a sign of an ethnic group's lack of self-confidence, which in itself is a prerequisite for sustainable development. In

addition, language death entails loss of cultural diversity. Loss of diversity is regrettable not only from a philosophical or aesthetic point of view; it can also deprive us from data that are crucial for increasing our insight into the human language capacity and loss of indigenous knowledge on the environmental resources and ecological relations that these groups developed and nurtured for generations.

It limits our possibilities to recover history and with the language, the indigenous knowledge of the people disappears as well. It is evident that the loss of linguistic diversity is an impediment for linguistics as an empirical discipline.

The description and documentation of Me'en and Dizi languages and cultures includes the description of the grammatical sketches, preparation of trilingual dictionary and documentation of oral narrative and material culture of the two languages. As the research of this kind need natural and ample data, the research team plans to stay among the peoples under study for successive prolonged fieldworks. Therefore, the major research team has three sub-teams (grammar sub-team, lexicography sub-team and folklore sub-team) organised to work on describing and documenting the Me'en and the Dizi languages.

Principal Investigator: Dr. Desta Amare

Members:

1. Mulugeta Seyoum (PhD)
2. Girma Tesfaye (PhD Candidate)
3. Melkeneh Seid (PhD candidate)
4. Tsegay Woldemariam (PhD Candidate)
5. Awlachew Shumneka (PhD candidate)
6. Gessesse Nigusse (PhD candidate)
7. Firehiwot Bayu (PhD)

8. Yohannes Adigeh (PhD)

Documentation and Description of the Endangered Elements of the Language, Oral History and Material Culture of the Gurage

Executive Summary

Our world is a land of multilingual and multicultural society. According to a researcher in this field, 6,912 languages are spoken in the world. But, their levels of development and function are also different. Some of them have wider communication and others have narrow communication and distribution. In almost every part of the world, the majority of the minority peoples' languages are endangered and disappearing and this is taking place at an alarming speed. A language is *endangered* when it is on a path toward extinction. Without adequate documentation, an extinct language and culture can never be revived. About 97% of the world's people speak about 4% of the world's languages; and conversely, about 96% of the world's languages are spoken by about 3% of the world's people. Most of the world's language heterogeneity, then, is under the stewardship of a very small number of people.
Ethiopia is also a country of diversified cultures and languages. More than eighty language varieties are spoken in Ethiopia. According to a study conducted by the researchers, more than 21% of Ethiopian languages are endangered. Gurage language is one of the endangered Ethio-Semitic language varieties. Since cultural elements of any society are expressed by their languages, the endangerment of the cultural elements is also expressed by their languages. The danger becomes worse where the language of the society is not a written language.

The Gurage people in general and each Gurage community in particular do not have a writing system for their languages. Hence, the Gurage elders transmit their cultural elements and historical events through words of mouth in the traditional ways learned from ancestors. This situation makes the Gurage oral history of more susceptible to change and puts it at severe risk. This is because of decreasing number of prominent story tellers, popularity of oral narrations and fast changing socio-economic situations. The extinction of these grand narratives signals a death of every aspect of the communal Gurage life if it is not properly planned and managed. The norms, customs, belief systems, philosophies, and identities of the people will perish if urgent preservation and conservation mechanism is not devised.
The other channel of the Gurage people to transfer their identity makers is their material culture; such as architecture including the wisdom of settlement, construction and management of houses and their food preparation skills and knowledge. However, due to the influence of globalization in general and lack of one binding instrument within their identity in particular, the transferability of their material culture is under question. Therefore, this project is targeted to document and describe the endangered elements of the Gurage languages, oral history and material culture.

Principal Investigator: Dr. Ferehiwot Bayu

Members:

1. Awlachew Shumneka (PhD candidate)
2. Yohannes Adigeh (PhD)
3. Getachew Dewi (PhD candidate)
4. Yenealem Aredo (PhD) 5. Bejiga Teka (PhD Candidate)

The Role of Core Ethiopian Cultural Values for Nation Building

Executive Summary

Ethiopia is the home of diversified nations, nationalities and peoples. These various nations, nationalities and peoples have commonalities and peculiarities in their socio-cultural lives. Even though it is too difficult to easily define culture, UNESCO puts it as follows: "Culture is the whole complex of distinctive spiritual, material, intellectual and emotional features that characterize a society or a social group". Culture includes not only the arts and letters, but also the modes of life, the fundamental rights of the human being, value systems, traditions and beliefs. Thus culture gives humans the ability to reflect upon themselves. It is culture that makes us specifically human, rational beings, endowed with a critical judgment and a sense of moral commitment. It is through culture that we discern values and make choices.

Within the context of Ethiopia too, culture encompasses a diversity of social, economic, political, moral, religious, and psychological practices. It also includes Ethiopia's languages, traditions, folklore, building styles, food customs, costumes, implements, arts, beliefs, and new cultural creations. This project encompasses three sub-themes to be investigated that are supposed to have immense benefits for the process of nation building in Ethiopia. These are socio-cultural values, rituals and religious doctrines.

The research theme will begin its work by defining the concept of "core socio-cultural values" that have bound together the nations, nationalities and peoples of Ethiopia. Therefore, the core socio-cultural values can be taken as the belief system,

various traditional social activities that can be transmitted forward from generation to generation.

The concept of socio-cultural values documentation and promotion as a field of cultural research has in its own activities and right proceeds. Regarding the data sources, both primary and secondary data sources will be collected and used. Primary data will be collected from nations, nationalities and peoples of Ethiopia who will be selected through purposive and snowball sampling. The secondary data will be collected from library, web pages and from different documents relevant to socio-cultural aspects of national consensus. Cross cultural methods will be applied in the research process.

Rituals are performances or ways of actions and beliefs and that each has a beginning, a middle part and an end. In all societies, every group of people come together and performs a ritual for different purposes. The way they do, the words they utter and the tasks they commit, tend to follow a certain pattern and its own schedule as per their culture. This formalized behavior is what is meant by ritual. In rituals, people do their share of the beautiful arts, exchange positive ideas that the young generations have to build upon their fathers' and mothers' generations. Ritual ceremony ties together all social groups' men, women, old, young, wealthy and poor. Therefore, all participants have a similar ground to walk on, and fill free in expressing their will at that moment. Every rite, ritual, fest, ceremony follows the seasons of the year. Even everyday life is measured by events that humans face now and again. Humans became powerless and kept on being inferior to explain their surroundings, then they remained with memory inevitable to celebrate that case what had been lost in the past using rituals. In this project the role of core cultural rituals, among Ethiopian traditions, will be explained and documented with the objective of showing the roles they play in the process of nation building.

Thirdly, the role of religion in the process of nation building will be one of the core themes. Although the erosion of the legitimacy of religious institutions has become apparent in recent years during intra and inter-ethnic and religious violence, they had played significant roles in nation building process for hundreds of years in Ethiopia's past. Though this is the case, a glance at the dogma of various religions indicate that they potentially can have strong role in state building process since their dogma is about integrity, humility, honesty, hard work, fairness, justice, cooperation and solidarity. The internalization of this would lay the conducive condition for an effective and legitimate state. Thus, this sub-thematic project will explicate and document the basic religious tenets that may have vital impact on the process of nation building in Ethiopia. However, emphasis will be given to the dominant religious institutions such as the Christian and Islam religions.

Even though each sub-theme will use its own method as per the nature and objective of the issue under investigation, the grand project will mostly apply qualitative method both to collect the relevant data and their analyses. Primary and secondary data sources will be applied to obtain ample and valid analysis and meaningful findings and conclusions.

Principal Investigator: Dr. Gemechu Kedeir

Members:

1. Dr. Firehiwot Bayu
2. Getachew Dewi
3. Dr. Yohannes Adigeh
4. Dr. Haileyesus Muluken
5. Yenealem Aredo(PhD)
6. Bejigu Teka (PhD)
7. Awlachew Shumneka

In Search of Psychosocial and Political Issues and Technical Solutions for Addressing Social Media Use in Ethiopia

Executive Summary

In the last decade, the number of mobile phone and Internet users has been growing significantly in Ethiopia and all over the world. Adoption and diffusion of this technological platform enabled proliferation of social media use for information dissemination, content generation and interactive communication. Social media has also brought a very big impact on the public discourse and communication in society. In particular, social media are increasingly used in political context.

In Ethiopia, especially during the last couple of years, social media (social network sites such as facebook, microblogging services such as Twitter, and video hosting service such as youtube) are widely used in political context. Leaving aside the various opportunities that the social media brought, it also creates a potential problems that can harm the society and the country at large, and such problems include fake news (misinformation), cult following are few among many others. This phenomenon should be observed and deliberated by various disciplines such as psychology and sociology, information communication and technology, political science, linguistics and journalism. Thus, the following section will highlight each of the core areas of the social media use in Ethiopia and research that will be explored by a wide range of disciplines.

The first core sub-thematic area is psychosocial issues and impacts of social media usage in Ethiopia. Social media uses are essentially interlinked to the psychosocial behavior of the society. It is then imperative to start with the behavioral element and build on top of this very foundation. Social media is largely

designed for use by adult segment of society but it has been found that children younger than age thirteen and those in teenage years actively engaged in using social media. If individuals wisely and properly use social media they are believed to contribute to their psychosocial development and well-being and if misused they would be detrimental to individuals' psychological well-being and development like in cyber bullying and violence, and Internet addiction. In line to this, this study aimed to examine the impact of social media usage in psychosocial development and well-being of individuals in Ethiopia. In this regard, the study aims to assess the contribution of social media usage in identity development and well- being of adolescents, to determine the magnitude of cyber abuse (such as cyber bullying) and factors contributing to cyber abuse, to determine the magnitude of Internet addiction and factors contributing to Internet addiction, to identify the impact of social media usage in mental, social and educational functioning of individuals and finally to identify parental, governmental and community concerns as far as social media usage by adolescents and young adults is concerned.

The second core sub-thematic area that the study will investigate is political ramification of social media use in Ethiopia. Sound use of Internet technology has radically changed the mode of promoting political programs. Notwithstanding this fact, the use of this technology for politics has led to mixed views. The widely recognized misuse of the technology is urging nations to rethink its free use and prompting to device protective measures. Apparently, over the past two decades Internet technologies have played a vital role in the economic and social lives of Ethiopians. However, quite recently the social media has become an instrument to instigate ethnic hostilities and wide spread violence throughout the nation. To calm down the insatiability, the government frequently disrupts Internet

connections. This has caused untold distrust on the business and scientific communities. This study seeks to uncover mechanisms that would help the government and the general public to ensure secure and wise use of social media without disrupting regular services. To this end, the study explores the legal, constitutional, and ethical ethos that would frame ethical use of the technology for promoting politics. In doing so, the study intends to fill the existing gaps in the scholarly literature and proposes some insights for policy making.

Finally, the last core sub-thematic area is big data analysis of Ethiopian social media contents and platform development. With the explosion in the number of social media sites and the volume of data they produce, analyzing this publicly available (big volume of data) content on social network sites has become an increasingly important scheme to inform socio-political issues. In this regard, using the state of the art machine learning and artificial intelligence techniques, we will try to unearth different factors related to the current social media practice that are undertaken with Ethiopia hashtag, locating the major origin of various eccentric contents and furthermore. Analysis of the current situation and the previous sub-thematic area provides the requirement (functional and non-functional) to further design and develop various information technology artifacts such as predictive algorithm that identify and inform abnormal events, webcrawling tool that will capture political contents and other tools and techniques that can help to extract and filter inappropriate contents.

Generally, the study will attempt to uncover various issues related to different disciplines and foster sound use of the Internet and social media to enhance the socioeconomic and political activities in Ethiopia

Principal Investigator: Dr. Elfelious Getachew

Members:

1. Dr. Getachew Mengesha
2. Dr. Moges Ayele
3. Ass. Prof. Mekuria Mekasha
4. Amanuel Negash
5. Meareg A. Hailemariam

Minorities, Peripheries and Frontiers: A Study of Peoples and Cultures of the Gambella Region

Executive Summary

This thematic research project is an interdisciplinary engagement aimed at studying the Gambella National Regional State, which has been long inhabited by a mosaic of ethnic groups with their own distinct languages, cultures, and socio-economic formations. The region is predominantly inhabited by five ethnic groups who consider themselves natives to the area, namely the Anywaa, Nuer, Majangir, Opo and Kumo. In the past, the indigenous peoples of the Gambella region were marginalized politically, economically and socially. They did not have access to government services such as education, healthcare, clean water and security. The peoples of the Gambella region have also remained at the periphery of Ethiopian studies. It is from this conception in mind that the IES has planned to conduct an original research on the minorities, and peoples of the peripheries occupying not only the borderland in its physical sense, but also living on the margins in its social and historical sense. Gambella's status as a border region, its multi-ethnic composition, its exposure to the Sudanese civil war as well as the inner-Ethiopian dynamics between center and periphery deserve examination through

scientific analysis. The project has three components focusing on a wide range of issues related to the political and social history; economic, cultural, and linguistic features such as traditional belief systems and practices; indigenous knowledge systems including traditional methods of conflict resolution and environmental resource conservation wisdom; the dynamics of interactions and conflicts; refugees; livelihood basis; and the socio-linguistic aspects of the languages spoken in the region as well as issues related to mother tongue education practices and implementation. The project will be carried out by employing a systematic collection and diligent analysis of primary and secondary sources for three years consisting different phases. The research will begin with intensive review of literature related to the three thematic areas to identify the basic areas of concern and to fill existing knowledge lacuna about the history, cultures and socio-linguistic features of the peoples inhabiting the region. The literature review will also help us to clarify our position and find a direction for this research. Moreover, extensive field study will be carried out in the Gambella region to gather available data. The purposes of the fieldwork are: to gain a deeper understanding about the views and perceptions of a cross-section of the society; to reassess conclusions of the preliminary analyses; and to fill knowledge gaps. We will also gather data through interviews alongside working on records. Particularly, in order to get "insider" views, interviews will be conducted with elders of the various ethnic groups of the region. Finally, the findings of the study will be published and disseminated. This project involves several researchers from the Institute of Ethiopian Studies, other colleges/institutes of Addis Ababa University, and Gambella Universities; collaborators from governmental and non- governmental organizations; and two PhD candidates.

Principal Investigator: Dr. Teferi Mekonnen

Members:

1. Aklilu Yilma (Associate Professor)
2. Ahmed Hasen (PhD)
3. Takele Merid (PhD)
4. Desalegn Amsalu (PhD)
5. Tirsit Sahledengle (PhD candidate)
6. Abdussamad H. Ahmad (PhD)
7. Girma Mengistu (PhD)
8. Nuredin Aman (PhD candidate)

COLLEGE OF NATURAL & COMPUTATIONAL SCIENCES

Investigation of the North Wollo Volcanic Province: Implications to the Geological Resources and Stratigraphy of the Ethiopian Volcanic Plateau

Executive Summary

The Ethiopian volcanic plateau is the youngest example of continental flood basalt province (CFBP) dated at 30 Ma. The stratigraphy of the volcanic plateau in Central and Northern Ethiopia (e.g., Wollo and Tigray) is sub-divided into three formations, namely from bottom to top Ashenge, Aiba and Alaji. The volcanic plateau is then capped by a number of large shield volcanoes termed as Tarmabar formation. Reconnaissance field investigation in Kulfamba area (North Wollo) revealed the occurrence of Mn-ore body associated with the overlying (post-traps) sedimentary units. This new observation shows that Mn-ore and sandstone are new units in the volcanic facies of the Ethiopian CFBP. The existence of such new lithologies did attract our attention to propose this project that affords the opportunity to understand the stratigraphy and economic potential of the Oligocene pre-rift volcanic facies. The results and knowledge gained from this project can be applied elsewhere in the Ethiopian CFBP. Therefore, this study will have a broad, and perhaps, country-wide implications.

This project will integrate field and geochemical investigations to achieve the desired outcomes. The thematic research will have two major components. These are:

The first sub-thematic research deals with the Stratigraphic reconstruction of the Oligo-Miocene Ethiopian Volcanic

Province in North Wollo. This component will focus on the stratigraphy and rock units in the research area. It will describe and characterize the newly discovered sediments and their stratigraphic relationship with respect to the known/well established stratigraphic units of the Oligo-Miocene time. Ultimately, the component will propose the redefinition of the Cenozoic stratigraphy of Ethiopia based on the observations and interpretation in the study area.

The second sub-thematic research focuses on the Mineral Resource Potential of Post-Trap Sediments in North Wollo. The case of Kulfamba Area will be studied in this component of the research. Under this research, the volcanic sequences and the newly discovered sediments will be evaluated for their economic potential. The Mn-ore occurrences will be evaluated in detail in terms of their grade and tonnage. Recommendations on their exploitability and related economic and technical issues will be made.

The research applies four major research methods and associated activities categorized under four work packages (WPs), namely: Remote-Sensing and Geographic Information System (RS-GIS) method involving analysis of satellite imageries and aerial photographs; field methods involving field investigations and sample collection; laboratory methods involving experimental analyses (microscopic, sedimentological, XRD, geochemical and paleontological investigation on selected representative minerals, rocks and fossils) and computer-supported modeling and hypotheses development. In this project, more than 6 postgraduate students will be participating finally graduating in various sub-disciplines of Earth and related sciences.

The outputs expected from the research include: geological

maps and accompanying geologic cross sections at various scales for Kulfamba locality and other potential areas of mineralization; a detailed description of the geological history and potential of geo-resources; and paleo-environmental models for the Oligo-Miocene times in northern Ethiopia. Additional outputs are photographic documentation to be taken during the field mission; a new set of quality instrumental chemical and age data for international geoscientific data bases; new scientific knowledge and understanding on massive volcanic eruptions, intervening continental sedimentation as well as paleo-environments during Oligo-Miocene times; publications; trained manpower in resource exploration, evaluation and development; and strengthened research capacity and experiences of the collaborating institutions and creation of lasting cooperation among local and international stakeholders.

Principal Investigator: Prof. Dereje Ayalew

Members:

1. Dr Worash Getaneh
2. Dr Balemwal Atnafu
3. Prof. Gezahegn Yirgu
4. Ato Adise Zemelak
5. Ato Siraj Beyan
6. Ato Ayana Abere
7. Ato Gizachew Ayu
8. Dr. Gilamichael Kidane
9. Dr. Raphael PIK

Selecting and Validating the Efficacies of a Few Medicinal Plants from Southern Parts of Ethiopia to Combat Infectious and Non-communicable Diseases with Emphasis on Sustaining the Plant Biodiversity

Executive Summary

The plant biodiversity of Ethiopia is still not fully studied, properly validated and exploited to benefit the health of the people and contribute to the economy of the country. Many emerging countries of the world are going ahead in making proper and sustainable use of medicinal plants. Ethiopia in its current Growth and Transformation Plan (GTP2) is giving emphasis to the sustainable use of medicinal plants. In this run for fast development we can contribute by selectively targeting the potent medicinal plants to alleviate the health burden of the people of Ethiopia and contribute to the knowledge at large for users beyond borders.

Thus, the major objective of this thematic project is clearly addressed in three sub-thematic researches. Sub-thematic research (STR) I is ethnobotany and conservation study. The major methodologies to be employed are reconnaissance survey to be conducted at the beginning of the research to identify the study sites that are appropriate to address the objective of this sub-thematic research area. Different documents and archives related to ethnomedicinal studies and plant resources will be collected and analyzed. Ethnobotanical information on traditional medicinal plants will be collected through participatory rural appraisal (PRA). Plant specimens will be collected and representative specimens will be put in the National Herbarium (ETH) of the Addis Ababa University.

Sub-thematic research (STR) II is a study on malaria prophylaxis and controls. Malaria still affects young children and vulnerable groups (reproductive age women). The study will be mainly conducted using the rodent plasmodium parasite, *P. berghei (*ANKA strain) by passaging it in Albino mice in the Animal House of the College of Natural and Computational Sciences. Different extract doses will be tried to get potent plants that suppress the load of the parasite in comparison to know control drugs.

The third research component is addressed in sub-thematic (STR) III that studies the efficacy and validation of few selected medicinal plants against some infectious and non-communicable diseases. In this study, antimicrobial experiments will be conducted by testing the inhibitory activity of the extracts, fractions & compounds against pathogenic test organisms (bacteria, fungi). The agar disc and well diffusion methods for the antimicrobial tests will be employed.

In vivo anti-inflammatory activity will be evaluated on the basis of inhibition of carrageenan induced Mouse hind paw edemas and the experiment on diabetics will be conducted by induction of *Diabetes Mellitus* by a single intraperitoneal (i.p.) injection of 100 µl of sterile phosphate buffered solution containing streptozotocin (STZ) (65 mg) and hyperglycemia would be established four days post treatment. Glucose concentration will be measured in a blood sample obtained from tail puncture. Only animals that will have a blood glucose concentration higher than 20 mM, four days after treatment with STZ will be used for the study. All extracts and fractions of the selected medicinal plants will be subjected to toxicity tests. The test protocol will be as per the Organization for Economic Co-operation and Development (OECD) *Guidelines for the Testing of Chemicals*.

In conclusion, some of the major outputs of the thematic research will be acknowledge generation and establishment of data base on the most useful traditional medicinal plants and laying the foundation for sustained use of medicinal plants, packaged, safe and affordable formulations, capacity building by engaging MSc and PhD students and creation of a strong collaborating research team with complementary expertise of different departments and colleges within Addis Ababa University and other stakeholders, such as Ministry of Health and private enterprises.

Principal Investigator: Prof. Yalemtsehay Mekonnen

Members:

1. Ariaya Hymete
2. Ermias Dagne
3. Tegenu Gelana
4. Melaku Wondafrash
5. Tigist Wondimu
6. Amelework Eyado

Aquatic Production and Productivity in the Rift Valley and Awash Basins

Executive Summary

The Rift Valley (RV) and Awash basins are two parts in Ethiopia that are experiencing the fastest population and industrialization growth. Like in other parts in Ethiopia, people in these basins rely on the immediate natural resources to meet their daily needs. The RV contains most of Ethiopia's lakes and aquatic resources such as fish, macrophytes, algae and

experience severe sedimentation that is threatening the water storage capacity of the natural lakes (Ziway, Hawassa, Chamo) and reservoirs (Koka dam). The RV and Awash basins have experienced overfishing, overexploitation of lake and river vegetation, deterioration of water quality as a result of pollution and sedimentation and resource misuse in general. This proposal attempts to address some of these questions through research on options to increase production and productivity of fish through culture and capture fisheries and aquaponics. Some of the research sites selected for this purpose have conducive environmental conditions for the enhancement of aquaculture and aquaponics, which will help to offset the environmental pressure that communities impart on the natural system to provide for their livelihoods. The proposal also aims to integrate research, capacity development and outreach programs, and therefore puts stakeholders at the forefront of the research agenda. The TR is composed of 3 Sub-themes – 1) Sub-thematic 1 deals with improving fish production through aquaculture, aquaponics and enhanced capture fisheries; 2) Sub-thematic 2 – research on macrophyte and fine sediment ecology in the basins with the aim of finding scientific options to control undesirable macrophyte blooms and sediment accumulation, and 3) Sub-thematic 3 - monitoring nutrients and land use dynamics in the basins with the goal of improving livelihoods of communities in the region. The TR proposes a work plan from 2018-2022 and a budget of 4.63 million Birr to achieve the objectives it has set – increased productivity of fish resources, reduced ecological impacts of macrophytes and sedimentation and biological tools developed to monitor ecological changes in the basins. At least 12 PhD and several MSc students will be trained through this project.

Principal Investigator: Prof. Seyoum Mengistu

Members:

1. Prof. Abebe Getahun
2. Dr. Hayal Desta
3. Yiblet Dagnachew
4. Maheder Mekonnen
5. Dr. Akewake Geremew

Searching for Genes Resistant to Field and Storage Insect Pests and Diseases in Ethiopian Common Bean Landraces: Baseline studies to arrive at insect pest and disease resistant & high yielding common bean variety

Executive Summary

Common bean is popularly grown in Ethiopia for food and income generation. The crop yield is highly affected by insect pests and various diseases. The chance of limiting the extent of these limiting factors is high as the crop is rich in landraces which may have genes responsible in overcoming the attack by the pests. In Ethiopia, over 500 common bean landraces were collected by Melkassa Research Center, Biodiversity Institute and Haromaya University and awaiting for different kinds of tests. Earlier work by different scholars confirmed the existence of genes responsible for overcoming damage by pests in general and insects in particular. The attempt of the current thematic research is to harness the available potential of common bean landraces in pest management which may pyramid with high yielding common bean variety to produce pest (insects & diseases) resistant and high yielding variety which one can call three in one (insect resistant, disease resistant and high yielding variety). The thematic research is organized in three sub-thematic researches where sub-thematic (STR) I is focused on insect pests, sub-thematic (STR) II on diseases and sub-thematic (STR) III on genetic aspects of common bean landraces. A field

trial which consists of over 200 landraces in the first phase will be executed in non-replicated one row trial and evaluated at different crop growth stages (seedling, vegetative, flowering and maturity) against insect pests and diseases. Harvested seeds will be evaluated in the store in non-replicated free choice test where seeds of each landrace will be kept in a cloth bag. The first 10 best landraces will be promoted to the 2nd phase experiment and will be laid out in Randomized Complete Block Design in three replications. Harvested seeds will be evaluated in the store in a Completely Randomized Design in three replications in a no-choice test. This experiment will be conducted in a plastic jar. Ten adults of *Zabrotes subfasciatus* will be introduced to each plastic jar to initiate infestation. Seeds to be used for this experiment will be stored at below 0^{O}C up to the start of the experiment to keep the seeds free from internal infestation. In the 3rd phase the first three best landraces will be planted in the field in a Randomized Complete Block design in four replications. Harvested seeds will be used for storage experiment. This trial will be done in a no-choice test in a completely randomized design in four replications. Similar number of *Z. subfasciatus* will be introduced. Collected data will be analyzed to know the best landrace which have three traits in one: insect & disease resistant and at the same time high yielding.

Principal Investigator: Prof. Emana Getu

Members:

1. Dr. Driba Mulata
2. Dr. Teshome Soromessa
3. Dr. Birhanu Hiruy
4. Dr. Tesfu Fekensa
5. Dr. Dereje Beyene
6. Kassahun Tesfaye

7. Dr. Mulatu Wajari
8. Dr. Daniel Getahun
9. Mr. Tilahun Mekonen
10. Dr. Sisay Dugassa
11. Dr. Anteneh Tesfaye

Forest Ecosystem Services Modeling, Effect of Eucalyptus Species Elimination in Understory species and Soil Condition, and Innovation of Ginger Integrated Disease Management Technologies in Central and Southwest Ethiopia: Towards Sustainable Development and Management of Environmental Resources

Executive Summary

Forest provides a wealth of various goods and services to human society that is derived directly or indirectly from ecosystem functions. Recently, the importance of biodiversity for underpinning the delivery of ecosystem services and the possible effects of biodiversity loss is well recognized. However, there is an ecosystem degradation and biodiversity loss across the earth that influences the availability of ecosystem services. It threatens the ability of ecosystems to provide goods and services for human beings.

Ethiopia is an important regional center for biological diversity due to its wide ranges of altitude, its great geographical diversity with high and rugged mountains, flat-topped plateaus and deep gorges, incised river valleys and rolling plains. Though Ethiopia has diverse forest resources, they are threatened mainly by anthropogenic causes. Besides, plantation forest has high coverage in Ethiopia, despite the opposite rhetoric mainly on *Eucalyptus globulus*. *Eucalyptus* spp. is still by far the dominant

planted tree in Ethiopia. The tree has a nursing effect for the regeneration of natural forest. In addition it can be cost-efficiently used for restoring natural forest ecosystems especially on degraded and denuded sites, fast growing exotics (e.g. *Eucalyptus globulus, Acacia saligna, Acacia decurrens*) have the ability to withstand harsh environmental conditions and rapidly attain canopy closure. They can be efficiently used for establishing a pioneer forest and serving as foster trees for later enrichment planting of indigenous and shade-tolerant trees. However, Gullele botanical garden keeps on replacing *Eucalyptus globulus* plantation with indigenous forest. Therefore, understanding of the implication of completely removing *Eucalyptus globulus* on understory species, seed germination, soil nutrients and water is critical.

Among the provisioning ecosystem services, ginger is one of the non-timber forest products which is available inside the natural forests. Ginger; a rhizome bearing aromatic monocotyledon plant of the family Zingiberaceae is a typical “cash crop” and is the largest export-spice of Ethiopia, reaching 9000 Mts in 2009. Ginger was one of the major spices grown in Ethiopia. It plays vital role in livelihoods of more than 350,000 smallholder farmers whose lives depend on production, consumption and marketing of ginger, and also played irrevocable contribution for economic development of the country through generating foreign currency, employment and incomes. However, owing to the outbreak of ginger diseases, coupled with inadequate traditional agronomic practices, it is estimated that 85% of the ginger crop in the country was destroyed.

Principal Investigato: Dr. Seleshi Degefa

Members:

1. Prof. Teshome Soromessa

2. Wondimagegn Mengist
3. Tesfaye Alemu (PhD)
4. Feleke Sibhatu,

Climate Change/Variability, Impacts on Climate-Sensitive Sectors and Possible Mitigation and Adaptation Strategies in the Upper Blue Nile River Basin, Ethiopia

Executive Summary

Climate change and variability have wide-ranging effects on the environment and related sectors, including water resources, agriculture and food security, human health, terrestrial/marine ecosystems and biodiversity. Changes in rainfall pattern are likely to lead to severe water shortages/flooding and soil erosion. Rising temperatures will cause shifts in crop growing seasons which affects food security.

The government of Ethiopia aims to reduce poverty, accelerate economic development and achieve middle-income status by 2025. For such goal, the government launched the Growth and Transformation Plan (GTP) and the Climate Resilient Green Economy (CRGE) strategy. The Climate Resilient Green Economy (CRGE) is a strategic framework developed to protect the country from adverse effects of climate change and to support the development of a green economy through reduction of greenhouse gas emissions from four priority sectors (Agriculture; Forestry; Energy; and transport, industry, and buildings (the last three clustered as one sector).

In addition to the reduction of GHG emissions from priority sectors, the CRGE aims to increase the resilience of the most vulnerable sectors of the economy (including agriculture, water

resources and energy) to climate change as reported in various references. On the other hand, the National Meteorological Agency of Ethiopia (NMA) has initiated a National Framework on Climate Services and this framework focuses on climate research, modelling and projection.

The Upper Blue Nile River basin (UBNRb) has been identified as an area of economic growth corridors with a high potential to contribute to the GTP (e.g. hydropower, irrigation, fishing and tourism). However, climate change, environmental degradation, hydrological variability, water management practices, adaptive agricultural activities, efficient energy production and siltation (sedimentation) have not yet been addressed in a coordinated manner.
In this thematic research project, the potential/possible hazards and risks of climate change (e.g., through increasing intensity and frequency of extreme events) on the water, energy resources, soil moisture and agriculture will be assessed and the appropriate measures for building resilience to climate change and variability will be proposed. Thus, this research will address the long term changes/variability in past/present/future climate and its impacts on water, energy resources and agricultural activities over different sub-regions of UBNRB and propose mitigation options to cope with the adverse effects of climate change and land use/land cover changes.

Keeping this in view, this thematic research is organized into three sub-thematic components. The sub-themes will involve a large number of expertise from a variety of disciplines, apart from departments at AAU, several expertise from different institutions at home and abroad will engage to address the problem.

The research will employ mixed methods of data collection and analyses that combine qualitative and quantitative methods.

Both secondary and primary data sets on variables relevant to climate, livelihoods, policy, etc will be collected from relevant sources. Robust methods of data analysis will be employed such as rotated empirical orthogonal function for climate variability; non-parametric methods for trend analysis; global and regional climate down-scaling methods; programming languages (such as MATLAB, NCAR Command Language (NCL)); GIS and Remote Sensing methods; Regression analysis; etc. In addition, various software applications and packages such as ArcGIS, SPSS, Water Evaluation and Planning (WEAP) tool, etc will be employed to aid data analysis.

During the project implementation period under the three sub-thematic research components, 15-20 PhD and 20 MSc students will be trained and a number of research articles will be published in reputable journals. The proposal will be conducted for a period of three years starting from November 2019 to September 2022 with a total budget of 4,845,000 Ethiopian Birr.

Principal Investigator: Dr. Tadesse Terefe

Members:

1. Dr. Dessie Nedaw
2. Dr. Kassahun Ture
3. Dr. Messay Mulugeta
4. Dr. Tilahun Azagegn
5. Dr. Tesfay Korme
6. Dr. Gudina Legese
7. Dr. Desalegn Yayeh
8. Dr. Belay Simane
9. Prof. Gizaw Mengistu

Prevalence and Impact of Mycotoxins in Animal Feeds along the Dairy Value Chain in Central Ethiopia

Executive Summary

Ethiopian livestock production and productivity is currently being challenged by poor nutrition in various livestock production systems. This is mainly due to technical challenges encompassing shortage of feed supply, dominance of poor quality feed resources, seasonality in quality and quantity, soaring feed prices and poor marketing system. In addition to these technical challenges, most of the feed resources in Ethiopia are not well studied from perspectives of food safety. One of the challenges in the world has been linked to micotoxins. These are chemically diverse groups of compounds that are secondary metabolites of toxigenic fungi. The molds/fungi contaminate grains either while on field or during postharvest while on storage. Besides contaminating the food/feed, the mycotoxins produced cause problems in animal husbandry. The toxic effects range from poor feed intake and conversion, digestive distress, low reproductive performance, immunity deficiency, stunting, tumor development and death. Human beings are also affected either directly via consumption of contaminated grains or indirectly via the milk from the infected cow. Globally, mycotoxins (especially aflatoxins) are the most important contaminants of livestock feed. Aflatoxin is produced by the fungus *Aspergillus flavus* and related species are toxic to humans, fish and many other animals, even in low concentrations. The presence of mycotoxins, in particular aflatoxin B1, can cause significant health problems as well as severe economic loss, and are therefore regulated with respect to maximum acceptable concentration for various feed and foodstuffs. In the case of Ethiopia, some studies have shown the occurrence of mycotoxins in some cereals and milk. However, in-depth study on awareness of the value chain actors in the

dairy value chain and the extent of the problem is not well studied. The presence of mycotoxins and their impact on animal and human health under the country's situation seeks due attention. Therefore, this study is trying to fill the gap by investigating the extent of mycotoxins contamination from feeds to food along the value chain and identify intervention points to reduce the contamination and leverage.

Principal Investigator: Dr. Tesfaye Alemu

Members:

1. Prof. Teshome Soromessa
2. Dr. Adey Feleke
3. Fikirte Asrat
4. Serawit Handiso
5. Feyisa Girma (PhD)

Ecosystem Service, Valuation, Carbon Sequestration, Allometry and Ecological Studies of the South West Vegetation

Executive Summary

Globaly and specially in Ethiopian condition, the environmental services and the existence values provided are not fully considered. This results in the destruction of the ecosystems. Thus, the ecosystems of southwest Ethiopia have faced challenges due to the non-recognized rate of earnings from this nature-gifted area. Besides, regionally southwest Ethiopia contributes a lot for the national economic development more than other areas because it provides plenty of ecosystem services and genetic variability but utilizing effectively with support of scientific data is still lacking.

The area is considered worthy of special scientific attention because it is the most prolific hydropower production area which facilitates Climate Resilient Green Economy of Ethiopia. However, the area has potential threats to the ecosystem services. This is due to lack of site-specific information of the ecosystem function, flow and holistic approaches of the stakeholders for conservation. In order to address the problems, the ecosystem services modeling and valuations can provide useful information for decision-makers. This information is often needed to address questions about changing land use, valuing natural capital, and analyzing co-benefits, tradeoffs among different ecosystem services.

Environmental factors are important not only in detecting plant species distribution variations with spatial scale, but also for providing insight into the environmental requirements of the species needed for successful ecological restoration and the establishment of plantations. In addition, measuring biomass in local, regional and global scales is critical for estimating global carbon storage and assessing ecosystem response to climate change and anthropogenic disturbances. Thus, socio-economic data, satellite images, meteorological data, biodiversity and biomass data will be used for modeling using InVEST and SWAT software. The data will be analyzed by employing statistical techniques using R. The major expected output of the research will be quantifying, mapping, its spatio-temporal changing and economic valuation of ecosystem services and validated allometric equation development innovations. This will help for prioritization for immediate conservation actions and design appropriate conservation strategies by stakeholders.

The thematic research is encompassing sub-thematic research areas which include the following:

Sub-thematic research (STR) I involves modeling and valuation of ecosystem services at Megecha Watershed, Omo Gibe Basin, Ethiopia. Sub- thematic research (STR) II focuses on ecosystem service modeling, carbon sequestration potential of coffee-based forest and the adaptation strategies for climate change in southwest Ethiopia. The third sub-thematic research (STR) III deals with ecology and allometric modeling in Majang Forest Biosphere Reserve, Gambella, southwestern Ethiopia

At the end of the thematic project, promising technologies for landscape conservation, quantified ecosystem service and valuation, modelling of the services and ecological study which provides important information for decision makers, managers and experts in the southwest Ethiopia will be obtained. The application of those innovative technologies would greatly contribute to environmental, social and economic development of local communities such as protecting human health and ensuring environmental safety, reduction of erosion will be maximized. Best model for ecosystem service for agaro-ecosytem and reservoir and its catchment will be developed in the country. Additionally, measure the carbon stock of forest based coffee to show how climate change adaptation and mitigation of coffee forest will be revealed.

Furthermore, research capacity of the education staffs, different stakeholders and partner organizations will be built to ensure the sustainable application of the technology and model. The Project will strengthen University-industry linkage and promotes the adoption of innovative technologies. The other important output of the project is the generation of new scientific knowledge which will be published in journal articles and disseminated to international and national scientific communities.

Principal Investigator: Prof. Teshome Sormessa

Members:

1. Dr. BikilaWarkineh
2. Abreham Berta
3. Ayehu Fekadu
4. Semegnwe Tadese

Harnessing Resource-oriented Sanitation through the Development of Automated Struvite Reactor from Public Urinals in Addis Ababa: Pilot-scale optimization and impact assessment

Executive Summary

As fertilizer prices climb and the cost of conventional sanitation rises, converting urine into fertilizer will be an increasingly profitable solution for both those with fertilizer needs-small holder farmers; and those with wastewater disposal problems-urban dwellers and municipalities. To reap the benefits of this novel strategy, smallholder farmers need well-documented guidance based on practical experience in successful demonstration projects. The current proposed thematic research establishes workable solutions to the regulatory and logistical challenges in urine reuse, helping smallholder farmers to implement it successfully on their own farms. Source-separated urine provides many benefits over traditional nutrient management from wastewater, as it constitutes 80% of the nitrogen, 65% of the phosphorous and the potassium of a typical domestic wastewater. A number of questions and challenges remain before full-scale urine reuse operations can be realized. The proposed research is the extended phase of what had been

conducted in the thematic research round six (2016 – 2019), during which we were able to design and construct a manual struvite reactor in a batch reaction modality. Moreover, for the use of collected urine as is, we are investigating the survival of microbiota in urine stored for six months according to the WHO guideline. Studies are also underway to assess the load and persistence of antibiotic resistance genes of horizontal transmission significance. In the current proposed research, we hypothesize that automated struvite production from urine is an acceptable, effective, and sustainable source of nutrients for agricultural applications in Ethiopia. To test this hypothesis, the research integrates four sub-themes to address design, operation, practice and policy recommendation for the safe urine reuse.

Sub-thematic research (STR) I involves development of pilot-scale bioprocess technology for the recovery of nutrients from urine, which provides with design and operational guidelines of the hardware and the controlling software to address the practical issues related with the implementation of urine separation and collection systems. This STR will also conduct research to optimize the control of the different processes in the recovery potential of the automated technology. Sub-thematic research (STR) II focuses on the safety and yield of the struvite upon the different collection systems available for urine collection from public urinals in Addis Ababa. This sub-theme assesses the possible biological and chemical contaminants that may be available in struvite and analyzes the possible risk factors that may be of potential contamination through the production process.

Sub-thematic research (STR) III follows participatory approach that involves voluntary farmers in the field-application of field-based studies of urine-derived product application to crops. This sub-thematic area involves comparison of the efficacy of using

natural urine and the urine derived product struvite as agricultural fertilizers and evaluation of their impact on productivity as compared with the conventional synthetic fertilizer. The farmers' perceptions of the application of urine as a potential solution to productivity and the management and application of urine by peri- urban farmers of the various gender groups is believed to demonstrate the benefit on productivity from the farmers' perspectives.

Sub-thematic research (STR) IV focuses on laying out ways for sustainable implementation and ongoing operation of urine-derived struvite production. This sub-theme undergoes an integrated systems approach incorporating technology, management, planning and how the three areas come together to provide a framework that will guide farmers on safe use of urine derived fertilizer. The planning process includes exploring the situation (identify stakeholders and their interactions; understand the existing situation; develop goals and objectives); developing solutions (including institutional, financial, and technical aspects); and defining measures for implementation. This covers organizational, institutional, financial, legal and technical aspects of the urban sanitation solutions via urine management chain, from the collection and transport, to the final disposal or end use of treatment products. It also involves coordination to ensure varied and complex levels of service, among the possible stakeholders that have diverse interests.

The proposed field and laboratory-based experiments, including pilot tests of struvite formation from urine and creation of avenues for urban sanitation through fertilizer production from urine will be addressed in this research. Fieldworks will be conducted by involving small-holder farmers in the peri-urban areas of Addis Ababa and Hawassa in addition to the experimental plot work in Sidist Kilo Main Campus. Laboratory-based experiments at the Department of Microbial,

Cellular and Molecular Biology (MCMB) and AAiT will be conducted for development of the automated reactor system, software development for automation, optimal struvite production conditions with minimal pharmaceutical and biological contaminants. This will be followed by awareness creation at the farmers, private and government stakeholders' level will be done through various approaches. This will lead to planning of implementation at the urban level and policy briefing on the safe use of agricultural inputs derived from urine and other anthropogenic wastes.

Principal Investigator: Dr. Adey Feleke

Members

1. Agizew Negussie
2. Belay Semane
3. Hewan Demissie Degu
4. Fitsum Assaminew
5. Tesfaye Sisay
6. Zerihun Getaneh

Research and Training of Postgraduate Students for Sustainable Development and Biodiversity Conservation of the Endemic Fauna of the Guassa-Anaz Highlands of Ethiopia

Executive Summary

Ethiopia consists of the largest proportion of the Eastern Afromontane Biodiversity Hotspot (39.4 %), and is one of the world's richest countries in terms of Biodiversity. The Ethiopian highlands contribute the larger proportion of the hotspot and is an important centre of endemism. Water from the Ethiopian

highlands feeds the iconic many rivers including the Blue Nile River, which supports the livelihoods of millions of people in the lowland area including those in the Sudan and Egypt. The Ethiopian highlands, however are currently under increasing pressure of human impact and livestock grazing and needs an urgent conservation action.

One of the critical landscapes with large biodiversity in the Ethiopian highlands which is the focus of this project is Guassa-Anaz mountains. The landscape supports large biodiversity including Ethiopian wolf (*Canis simensis*), gelada baboon (*Theropithecus gelada*) and 22 other mammal species, 114 bird species (14 endemic to Ethiopia) and many bat species which are not yet studied properly. The landscape also provides a wintering ground for 38 species of Palearctic migratory birds and supports important and endemic plant species, including Guassa grass, giant lobelia, Erica moorlands, *Helichrysum* and *Alchemilla* species which needs urgent conservation focus. Part of the landscape is protected through Guassa Community Conservation Area.

With this research, we aim to coordinate our effort in research which can be used as a baseline data for the conservation of the endemic and rare wildlife species and improve the livelihood of the local community through transforming the traditional honey production to a modern honey bee keeping practice focusing on techniques of meeting the honey quality to International Regulatory Standards. This project incorporates four thematic research topics, i) Ethiopian wolf ecology and conservation threats, ii) rodent bases of the Guassa-Anaz highland for the conservation of carnivores and raptor birds, iii) diversity of bats and their ecosystem role, iv) optimizing honey production through modern hives to produce high quality organic honey and training of local community in using modern hives. After completing the data collection and writing separate publications,

we will articulate the relationship between the rodent density and distribution with the Ethiopian wolf and raptor birds distribution. What is unique for this particular project is the ecosystem approach linking the main prey (rodents) base of the Ethiopian highlands to conservation of the endangered Ethiopian wolf and raptors, and developing the interspecific interaction of raptors and Ethiopian wolf. The other unique value of the project is that this is going to be the first ever detailed study of the bat species in the Ethiopian highlands; and its huge economic value in quantifying honey quality of the Ethiopian highlands.

With this research a total of 6 staff members from the Department of Zoological Sciences (DZS) and Department of Botany will be involved. The team members behind this project include GIS and R based ecological modeling experts, ornithologist, mammal ecologist and entomologist who can effectively fill gaps of a research needed to successfully complete this project and give supervision for postgraduate students from different perspectives of their theses projects. This will give us an excellent opportunity in working as a team and integrate our efforts to strengthen our Department (DZS). At least 15 MSc students and 2 PhDs will be trained and we expect to publish over 24 papers at high-impact journals. This project will result in substantial data on the rodent dynamics which is the bases of large carnivore and raptor birds, Ethiopian wolf conservation, bats' ecology and diversity and methods in improving honey quality.

The project will have a long lasting effect in producing an important baseline data useful for the future conservation management of the Guassa Community Conservation Area, create an opportunity for the staff members of DZS to establish long term project on the bases of findings from this project

which enable them to succeed in stiff competition from international donors.

Principal Investigator: Anagaw Atickem

Members:

1. Dr. Bezawork Afework
2. Dr. Mesele Yihune
3. Dr. Araya G/Silassie

Improving 'Tej' Fermentation through Mixed Starter Culture Selection and Process Optimization for the Production of Consistent and High Quality Product

Executive Summary

'Tej' is a home-processed, but also commercially available indigenous honey wine (mead) produced in Ethiopia. Originally, the raw materials are honey, water and stems (with some leaves) of Gesho (*Rhamnus prenoides*) fermented for several days at ambient temperature spontaneously. To date, 'Tej' is produced through uncontrolled natural fermentation process for household consumption or local commercial purposes. 'Tej' for household consumption is solely produced from honey. It has been used to be a drink for the upper classes in the past but is now widespread in all walks of life. It is a preferred drink during secular holidays and weddings, and is also commercially available in 'Tej' vending houses and some restaurants all over Ethiopia. Presently, for commercial production of 'Tej', mixture of honey and sugar is commonly used. When sugar alone is used as a substrate, coloring agents are added so that the beverage attains a yellow color similar to 'Tej' prepared from honey.

'Tej' is considered by consumers as good quality if it has features such as yellow color, sweet flavor, effervescent and cloudy appearances. The flavor of 'Tej' depends upon the areas from which the bees have collected the nectar and the climatic conditions of the environments.

Honey is one of the major substrates used for the production of 'Tej'. It has recognized biological activity, the chemical composition of which depends on the floral origin, climatic, environmental and seasonal conditions, as well as on agricultural practices. Honey contains about 200 different substances, with the main constituents being fermentable carbohydrates and minor components of minerals, proteins, vitamins, lipids, organic acids, amino acids, aroma compounds, flavonoids, phenolic acids, 5-hydroxymethylfurfural (MHF) pigments, waxes, pollen grains, enzymes and other phytochemicals. Because of such important nutritional composition, honey is a very important health substrate for preparation of traditional fermented homemade drinks, such as mead (honey wine), sherry, sparkling wine and fruit-honey wine.

'Tej' fermentation is a spontaneous process that depends on microflora naturally present on the substrates and equipment. Lactic acid bacteria (LAB) and yeasts have been reported to be the predominant microorganisms in most of the African indigenous fermented foods and beverages. It was suggested that the proliferation of yeasts in foods is favored by the acidic environment created by LAB while the growth of bacteria is stimulated by the presence of yeasts, which may provide growth factors, such as, vitamins and soluble nitrogen compounds. LAB and yeasts are the predominant microorganisms found in 'Tej' (Ethiopian traditional wine).

Since microorganisms for the traditional fermentation are introduced spontaneously from the substrate and processing equipment, the fermentation process is carried out by unknown mixed cultures of microorganisms. The microorganisms could produce mixtures of products that may include methanol, fusel oils, ethyl carbamate, aldehydes, esters and acids as side products. Although methanol occurs naturally, at a low level, in most alcoholic drinks, it may occasionally reach concentrations of 18 g/l. Methanol is an important public health and environmental concern because of the selective actions of its toxic metabolite, formic acid, on the retina, optic nerve and central nervous system. The toxicity of methanol in humans is characterized by formic acidaemia, metabolic acidosis, blindness or serious visual impairment and even death. In addition to the toxic chemicals produced during spontaneous fermentation of 'Tej', pathogenic microorganisms, such as *Escherichia coli O157:H7*, *Salmonella Typhimurium*, *Listeria monocytogenes* and *Staphylococcus aureus* have been reported from different traditionally fermented beverages.

For the production of safe, high quality and standard 'Tej' the use of starter cultures which are microorganisms that are inoculated directly into raw materials in order to bring about desired and predictable changes in the finished product is inevitable. The development of starter cultures for a specific fermentation process usually involves isolation, selection and purification of microorganisms obtained from the fermented material. The selected microorganisms are then formulated into mixed culture consortia. Fermentation process optimization is another criterion that has become popular in many sectors of the food industry as a procedure for developing the best possible product in its class. Therefore, proper selection of yeast type and/or LAB, developing of starter cultures, optimizing the process condition are important strategies for the production of safe, consistent and high quality 'Tej' in Ethiopia.

Principal Investigator: Dr. Asnake Desalegn

Members:

1. Fitsum Tigu (PhD)
2. Dagim Jirata (PhD)
3. Prof. Mogessie Ashenafi (PhD)
4. Tetemke Meahrie (PhD)
5. Paulos Getachew
6. Tadesse Daba (PhD)

Holocene Environmental and Cultural Reconstruction of the Yeha Area, North Ethiopia: the Oldest State in Sub-Saharan Africa

Executive Summary

The formation of modern state in Ethiopia was initiated around 900 BC in northern Ethiopia, Yeha, a town in the mountain chains of Adwa. Climate induced population migrations from different directions converged at Yeha, resulting in mixing of the lowland migrants with the then settlers of the area to eventually form the state. Previous attempts to determine who were the indigenous settlers in Yeha, why did people migrate to Yeha area and chose to eventually settle there, what was the environment like at the time of the migration and settlement and what can we infer from the cultural mixing has not been comprehensively addressed. A multidisciplinary research team is involved in a research to work to reconstruct the ancient environment and culture of the Yeha area using multiple analytical and historical methods including: archaeological surveys and excavations; radiocarbon dating; depositional environment interpretation and biomarker analysis; and

interpretation of settlement, archeological and historical data. Results indicate that the indigenous inhabitants of Yeha were living in the area since ~5,000 Years BP as cattle herders and cultivators. Furthermore, the climate of the Yeha region around ~3500Yrs BP which was wet and cold had created a favorable condition for settlement. Along with this climatic change, the plant community was transformed from grassland (composed species with predominantly C4 photosynthetic pathways) to woodland (composed of species with C3 photosynthetic Pathway). The data so far shows that the Late Holocene transition has influenced the movement of the people in the lowlands with pastoralist mode of life to the nearby highland areas for better water availability and vegetation resources. Historical evidence also indicates that there was intermixing of the migrants with the indigenous people of Yeha leading to the formation of complex and stratified societies, which was the basis for the Aksumite civilization and the establishment of primordial Ethiopia. However, critical questions including: 1) the time of migration, settlement and intermixing of the Sabeans with the indigenous inhabitants, 2) who were the indigenous inhabitants, 3) who was settling in the newly discovered Tseratsure and Endagallie settlements and what was the timing of the settlement, 4) the type of vegetation during the Yeha time, 5) and the progression of the change of the climate during the late Holocene are not yet addressed. All the combined information will then help to reconstruct the ancient environment and culture of the Yeha State. What is very important to note here is that the Yeha State is the oldest state in the Sub-Saharan Africa. Therefore, understanding the ancient climate and vegetation of the region, the archeology, history and ancient settlement will offer a unique scientific data on the origin of stratified societies and the formation of the first state in the region. This in turn will have its unique contribution to the present Ethiopian socio-cultural setting, ancient environmental

study and for the establishment of tourism attraction site about Ethiopia's ancient cultures and environment.

Principal Investigator: Dr. Mulugeta Feseha
Members:

1. Dr. Ahmed Hassen
2. Ato Tekle Hagos
3. Dr. Teclehaimanot G/Selassie
4. Prof. Zerihun Woldu
5. Dr Tekie Fisseha
6. Brhan Teka

Biological Diversity, Human-wildlife Conflict and Alternative Livelihood at Chebera Churchura National Park – a holistic approach contributing towards harmonious coexistence between people and wildlife

Executive Summary

Biodiversity is one of the most important natural resources of Ethiopia attracting considerable number of tourists to the country. Particularly, wildlife resources such as birds and mammals are the major tourist attractions through bird watching, wildlife viewing and game hunting. Although 320 mammalian species, 918 bird species, 180 fish species, 72 amphibian species and 240 reptilian species are recorded in the country, a considerable number of other species are yet to be discovered especially in the remote areas of the country where protected areas have been recently established. To conserve the wildlife resources, 14% of the total area of the country is assigned as a protected area of which Chebera Churchura National Park is the one established in 2007. Chebera Churchura National Park (CCNP) is situated on the large forest landscape

with astonishing diverse wildlife species including the iconic African large mammals, African savanna elephants and African lions. The park is also home to many species of birds, reptiles, fish, amphibians and plants.

Although the park is one of the biodiversity hotspots of the country, it is under constant pressure through human induced threats such as cattle grazing, farming, encroachment, hunting, settlement and traditional honey collection that sometimes cause forest fire. In addition, there is a fierce human wildlife conflict through crop raiding, livestock lifting and human attack where the surrounding local communities develop negative attitude to the park and the wildlife.

The presence of these threats and the importance of the intact natural forest ecosystem to maintain the wildlife resources in Chebera-Churchura National Park initiated this thematic research project. Although there are few studies on the diversity of birds and mammals in CCNP, the studies were short term surveys and not comprehensive and hence ecological studies such as the population dynamics, interspecific interactions, and the role of the animals in habitat heterogeneity through seed dispersal have not been studied. On top of this, the diversity of bees and their role in pollination is missing and the magnitude of human-wildlife conflict is lacking to implement any resolution mechanism. Hence, the present thematic project is proposed to find out the wildlife resource of the park including mammals, birds, insects such as bees and honey bee flora that are important components of the ecosystem and its functioning, assesses the causes of human-wildlife conflicts and the extent of damage and possible intervention and minimize the dependency of the local community on the park and improve their livelihood through community outreach programs such as by training and supporting local communities involve in honey production using modern beehives.

Under the current project, it is aimed to prepare a bird checklist of the park that can serve the community and tourists as a guide and create awareness, bring to light some of the most ecologically important but neglected mammals (pangolines) to light, understand the bee diversity and use this fauna (bees) as an important biological resource to improve the community livelihood through honey production and minimize the human-wildlife conflict in the area for a harmonious co-existence between people and wildlife. The study on faunal diversity will also provide the opportunity to strengthen museum collections and will contribute in the educational and recreational activities of the Zoological Natural History Museum of Addis Ababa University.

In this project, it is expected to develop regional honey farmers' cooperative societies, which will act as watchdogs in the whole activities of honey production, collection, storage, packaging and marketing. In this way, whatever profit is made it should go to the people directly involved in honey production and related activities. In addition, local students will be mobilized through the bird/mammal watching clubs to participate in wildlife monitoring and serve as citizen scientists for sustainable conservation of the park. Furthermore, this project will give an opportunity for seven masters and two PhD students to be trained with close supervision and support of experienced researchers involved in this project.

Principal Investigator: Dr. Mesele Yihune

Members:

1. Dr. Tilaye Wube
2. Dr. Bezawork Afework
3. Dr. Araya G/Silassie

Developing Innovative Technologies for Sustainable Resource Recovery from Source Separated Organic Municipal Solid Wastes in the City of Addis Ababa (Ethiopia) and its Surrounding

Executive Summary

Cities are at the nexus of a further threat to the environment, namely the production of an increasing quantity and complexity of wastes. Waste collection rates are often lower than 70%in low-income countries. More than 50% of the collected waste is often disposed of through uncontrolled land-filling and about 15%is processed through unsafe and informal recycling.

According to Addis Ababa solid waste management system report (2010) the daily waste generation was estimated at 0.4 kg/capita/day with daily city waste production of 550 tons/day (200,000t/year) of which 65% is collected and disposed into a dump site. The waste composted and recycled accounts for 10% while the remaining 25% is dumped into open spaces, ditches, rivers and riverbanks. The inappropriate practices of dumping municipal solid wastes into the river catchments and open dumping areas; where it is washed by runoff during rains, and flows into rivers and seeps into shallow groundwater have resulted in turning the rivers into sewer line services and polluting the environment. It is therefore imperative to address these challenges in an integrated and innovative manner, in which key stakeholders including the public and private sectors are actively engaged.

Studies have indicated that from the total generated municipal solid waste, 60% is organic which can be recycled. This provides a comparative advantage in using solid wastes for compost and biogas production in developing country like Ethiopia. Therefore, exploring for alternative innovative

technological options for resources recovery and the effective and sustainable management of the City's solid waste is very critical.

Principal Investigator: Dr. Seyoum Leta

Members:

1. Dr. Ahmed Hussen
2. Dr. Dawit Diriba
3. Dr. Tedesse Alemu
4. Bantamlak Hassen (PhD candidate)
5. Hussien Ali (PhD candidate)

Water Quality of some Reservoirs and Lakes in Ethiopia: Assessment and evaluation of public health risk and its impact on food web interactions

Executive Summary

Environmental pollution is an ever-increasing problem in sub-Saharan Africa, where Ethiopia is an exemplary showcase. In Ethiopia, agriculture has been intensified, infrastructure and construction are booming, and urbanization is expanding and industries are flourishing. While these developmental activities are beneficial to the society, they affect the environment as the wastewaters they produce are discharged into aquatic ecosystems with little or no treatment of any kind. Eutrophication of freshwater resources is viewed as a serious problem due to the production of cyanotoxins (algal bloom) and their potential impact on the health of end users. Sources have reported the presence in Koka Reservoir of microcystins whose concentrations have greatly surpassed the guideline value set by WHO. Other researchers have also reported the

bioaccumulation of microcystins in the liver tissues of commercially important fish species collected from Koka Reservoir. Although confirmed records are non-existent, there are anecdotal evidences for the association of death or poor health of livestock and human beings with cyanobacterial blooms on the Amudde side of Koka Reservoir. Another study made in 2016 has also indicated the presence of some pesticide residues in some drinking water sources of Addis Ababa at levels that surpassed drinking water guideline values set by the World Health Organization. The other consequences of eutrophication/water pollution are the prolific growth of water hyacinth. These represent a serious threat to public health, aquatic and terrestrial life.

Water hyacinth has caused different problems in diverse aquatic ecosystems of the world with its impacts becoming more severe in Africa especially in Sub-Saharan countries, where new infestations are creating life-threatening situations as well as environmental and cultural upheaval. In Ethiopia, water hyacinth has been reported from different lakes of the country including lakes Ziway, Abaya and Chamo, and Tana since its first record in Koka Reservoir in 1965. It is considered a constraint to the development of the country owing to the multifaceted problems it causes including obstructing electricity generation, irrigation, navigation, and fishing; increasing evapo-transpiration resulting in water loss, increased cost of crop production, providing habitat for vectors of malaria and bilharzias, harboring poisonous snakes, causing skin rashes, and hosting agents of amoebic dysentery and typhoid. Currently, water hyacinth is estimated to cover about 50000 hectares of Lake Tana. The weed is greatly affecting fishing activities in several lakes, particularly in Lake Tana by obstructing access to fishing grounds, clogging and damaging net, and increasing costs (effort and materials) of fishing. It is also outcompeting and replacing indigenous plants (e.g. Hippo grass) which have

high nutritional value and were serving as fodder for cattle. Hence, livestock production is being affected by lack of nutritious natural feed in these lakes. Water hyacinth infestation is extending to the level where it has over swamped rice fields thereby hampering rice production around Lake Tana. Recently, about 800 ha of rice production has been damaged due to water hyacinth infestation. It also makes recession agriculture laborious and difficult. The total economic loss and expenditure associated with the control of water hyacinth is yet to be known.

On the other hand, macrophytes are now being considered a good source of food and fodder for humans, aquatic herbivores and farm animals. They are also used as fertilizer, ash, green manure, compost etc. apart from serving as the base of aquatic food chain. Recently, different researchers explored the possibilities of using them as feed source for livestock and as fish feed. The knowledge of chemical composition of macrophytes is very important in order to evaluate the food potential. In view of this, the present study aims to explore the biochemical compositions of macrophytes collected from Lake Ziway and Koka Reservoir, in Ethiopia. The potential antioxidant properties of their extracts will also be investigated. Furthermore, possible toxicity upon consumption of the macrophytes will be examined in mice in vivo tests.

Food webs demonstrate trophic structure (predator-prey interaction) and energy/mass flow relationships, and an understanding of food web is of growing importance in ecosystem management. For instance, in 1998 research demonstrated that the high fishing rate observed at lower trophic level is the result of fishing-down-the-food-web, and warned the unsustainable exploitation pattern at global scale. Insight into food-web interactions may also play a key role in understanding the effects of climate change on lakes. The foods that animals

eat often exhibit characteristic isotopic signatures, and the stable nitrogen isotope value ($\delta^{15}N$) indicates trophic position while the stable carbon isotope signature ($\delta^{13}C$) reveals its sources of dietary carbon. Therefore, the combined measurements of $\delta^{13}C$ and $\delta^{15}N$ can be used to examine how the basal carbon source of a food web is successively transferred to higher trophic levels. Ecosystem-based aquatic management has gained a wider recognition among the scientific community, managers and decision makers. Indeed, food web studies increase the optimum utilization of the inland water bodies by pointing out mis-utilization and/or overexploited resources in holistic context. In Ethiopia, food web study is an emerging field of research and interesting results on food web interactions were obtained for some lakes. We shall use a software model called Ecopath with Ecosim (EwE), which offers a network analysis and provides insights into the structure and dynamics of aquatic ecosystems.
The study focuses on reservoirs (Aba Samuel, Belbela, Dire, Gefffersa, Koka and Legedadi), Lake Tana, and rift valley lakes (Hawassa, and Ziway). Preliminary survey will be conducted to determine the actual study sites for each sub-theme.

Principal Investigator: Dr. Tadesse Fetahi

Members:

1. Dr. Demeke Kifle
2. Dr. Paulos Getachew
3. Dr. Samson Tilahun

Photovoltaic (PV) Solar Energy Powered Reverse Osmosis (RO) Desalination System using Lake Beseka in Welenchiti Area (Ethiopia)

Executive Summary

Water plays an important role in all our daily lives and its consumption is increasing day by day because of increased living standards of mankind. It has been estimated by United Nations Organization that by 2025, nearly 1.8 billion people around the globe will face severe water scarcity. In Ethiopian, nearly 61 million people lack access to safe water.

In addition, increasing access to improved drinking water is one of the sustainable developmental goals (SDGs). Based on recent study 78.40% of households in Welenchiti complain about scarcity of water and most of them get water piped from neighborhood even worse the nearby villages have no access to clean water at all. The clean water demand for the communities in this region is high. In addition, the electricity grids are not reliable and some community members are not even connected to the electric grid. We believe the fresh water needs of the community can be satisfied if saline water available from lake Beseka could be converted to potable water through desalination process.

Saline water desalination using reverse osmosis (RO) system powered by solar PV has been till now not tried and examined in Ethiopia. In this thematic research, three separate research works will be performed such as Designing and Constructing Reverse Osmosis Desalination Plant, Designing and deploying a solar PV achieve clean water supply coverage at rural, urban and national levels (85 %, 75% and, 83 %), respectively at the end of the second Growth and Transformation Plan.

Principal Investigator: Dr. Georgies Alene

Members:

1. Dr. Girum Ayalneh
2. Dr. Anteneh Marelign
3. Mr.Tibebu Getachew
4. Dr. Yedilfana Setarge
5. Dr. Tadese Terefe
6. Dr. Ramato Ashu
7. Dr. Sintayehu Nibret
8. Dr. Alemayehu Dubale

COLLEGE OF SOCIAL SCIENCES

History, Ethnography and Ethno-Linguistic Map of Ethnic Groups in Ethiopia

Executive Summary

The fact that Ethiopia is a country of multiple ethnic groups is an ostensive knowledge. There is no authoritative, scientific work from which we fetch an exhaustive number of living or extinct Ethiopian ethnic groups, their ethnographic features, and shared identities and interethnic relations of one with another. This research studies Ethiopian ethnic groups both in the past and present to produce a scientific and reliable source on numerical and key ethnographic features. In the history of Ethiopian Studies, there is no complete knowledge of ethnic groups in Ethiopia for academia, policy makers, politicians, and other concerned bodies that input ethnicity into a work directly or indirectly related to ethno-cultural, political, social, and economic matters. This research works to close such a lacuna. The data collection runs for three years divided into different phases. In the first phase, we prepare tools for data collection and complete a desk review before actual field research. This work will take six months from a grant award. In the second phase which comprises three stages, we will conduct actual field research across all ethnic groups. In the final phase, we will make systematization and compilation of findings to make ready for a publication. This phase will take eight months before the end of the entire project period. We believe preparing the material for publication and dissemination of an output will take a year after we complete the project. We also think to solicit a separate funding for the publication. The proposed publication is an Encyclopedia of Ethnic Groups in Ethiopia (Past and Present). For this research (for activities other than publishing),

a total funding of 1.5 million ETB is proposed. The work involves several researchers from the Institute of Ethiopian Studies, other colleges/institutes of Addis Ababa University, and regional universities; collaborators from national and local governmental and non-governmental organizations; and two PhD candidates. We have also submitted an application requesting support from Michigan University. With regard to beneficiaries, it is hard to exhaust the list of all of them since knowledge to be generated by this project will be bedrock for the activities of many government organizations and universities.

Principal Investigator: Dr. Desalegn Amsalu

Members

1. Ato Aklilu Yilma
2. Dr. Ahmed Hasen
3. Dr. Teferi Mekonnen
4. Dr. Takele Merid
5. W/ro Trsit Sahledengel (PhD cand)
6. Dr. Seyoum Mesfin
7. Nuraddin Aman (PhD cand)
8. Dr. Abdusamad H. Ahmad
9. Bamlaku Amente

Reconsidering State Building Approach in Federal Ethiopia: In search for 'our common interest and outlook'

Executive Summary

Ethiopia's venture into ethnofederalism in the 1990s was an amazing political undertaking. It was indeed marked by an unprecedented legal and political recognition of ethnic diversity.

It has brought a radical political shift to the state structure. Taking into consideration that many conflicts in pre-1991 Ethiopia can be traced back to the struggle for autonomy and a few for independence, the new system of ethnofederalism enshrined in the 1995 constitution recognized all constituent 'nations, nationalities, and peoples' right to self-determination-including secession. This new undertaking reconfigured the identity of the Ethiopian state. It has shifted from civic nationalism to ethnic nationalism.

It has now been close to three decades since Ethiopia began building the professed 'federal democracy'. The country is however encountering multiple political crises that are wrecking the federal experiment. The crisis not only is unique in its nature and lasted long but also geographically spread across the country with wide-ranging support.

A coming into power of the reformist Prime Minister Abiy Ahmed in April 2018 has encouraged an already mounting demand in federal reform. This really brings hope for the possibility of strong reforms, which can be the sources of stability. The recent announcement by the new Prime Minister to sit down with opposition parties and other stakeholders to talk about reforms needed to be introduced in order to better democratize the country has come as a relief and hope for change. It is a good initiative and really shows the Prime Minister's commitment to restore lasting peace in Ethiopia.
Yet, diverse groups with a feeling of injustice and being wronged become even more intense. Violence and simmering tensions (recent violent incident in Ethiopia Somali region, Wollega in Oromia, Hawassa in SNNRS and Assosa in Benishangul-Gumuz Region can be mentioned as examples) throughout the federation have continued months after the new Prime Minister took office. Ethiopian federal experiment

appears to be failing on nearly all fronts. This is suggestive of the existence of more complex dynamics behind the protests and violence. There are a wide range of critical factors that need to be considered that make the success of federalism somewhat like "mission impossible". Perhaps it is necessary to take a step back and reflect on federalism itself as a contested concept and critically reflect on how it works (or not) in the real world in Ethiopia and the reforms that the country needs to introduce in relation to federalism.

The benefit of practical reform is twofold; first, it will help us build strong and undivided Ethiopia, and secondly, it will appreciably slim down ethnically aligned conflict and turn the country into a successful federal democracy. Besides, federalism is an ongoing process in which countries have a duty to revisit their structure and adjust to a changing situation if necessary. In order to examine the main issues raised, the research will use questionnaire, in-depth formal and informal interview, focus group discussion (FGD), archival research, and personal observation.

The project has three major sub-thematic components: Federalism as a Means for Promoting Shared Values and civil nationalism in Ethiopia, Centering the periphery and *Medemer (togetherness):* An interface between National Cohesion and Accommodation of Diversity in the Multinational Federation of Ethiopia? The project will be a three-year research venture which will start soon after receiving fund. Generally, we need 1,683,000 million ET Birr to execute the project.

Principal Investigator: Dr. Seyoum Mesfin

Members:

1. Dr. Sisay Mengistie

2. Dr. Ketema Wakjira
3. Dr. Mohammed Dejen
4. Dr Desalegn Amsalu
5. Dr. Amanuel

Body Politics in Ethiopia: Violation, Modification, and Self Care of Subjectivities

Executive Summary

Traditionally, body politics has mainly been understood as the divine power of a king. This understanding, mutatis mutandis, can only consider 'corporeality' in terms of inheritance of power by a certain heir from his predecessor. Hence, traditional conception of body politics is related with divinity that accords absolute power to a crown and to the king that embodies the crown.

In Ethiopian history, both traditional and modern empires drew legitimacy from such understanding of body politics or body and politics. For instance, the last king of the Solomonic dynasty, Haile Selassie I, was not just King of Kings but also Elect of God. While it sucks politics out of everyday quotidian embodied experience in its articulation of power as a force that emanates from divinity, the conventional conception of body politics also renders bodies outside of kingship unaccounted and expendable. Modern power that was articulated in European Enlightenment thinking gives more credence to mind than to body. Enlightenment rationalization even confines bodies to sheer passion and irrationality. The 'mindful' being the White man that was universalized through Enlightenment projects particularly colonialism, non-Western subjects have been taken as natural

fleshes who can only be canvases of their tradition and culture but not modern subjectivities implicated in the raced gendered, and sexed global capitalist system. Conceptualizing power this way, empires have committed multiple and multilayered violence against ordinary people.

However, the ways in which we think of power and body tremendously changed so much so that bodies have been conceptualized as sites of power-knowledge relations. Put differently, modern power operates on and through bodies reproducing certain forms of subjectivities. In *Discipline and Punish*, Michel Foucault shows how the modern state invents new technologies of power to manage bodies (life and death) through surveillance as well as through skill and knowledge formation/development. Feminist theorists also highlight the ways in which social relations are contested and negotiated on and through bodies. This understanding of the relation between power and body helps us to distance ourselves from taking bodies as mere/natural canvases of tradition, culture, and group identity on which stable patterns are projected no matter how those identities are said to be complex. This calls for reconsideration of bodies as thinking beings, archives and in terms of power relations.

Despite the fact that such kinds of anti-essentialist reconceptualization of body politics have produced tones of researches so as to imagine lives or subjectivities anew, Ethiopian studies has been mainly engaging with written archives relegating bodies to zone of primitivity and immaturity. That is why, when they are considered in sporadic old and new Ethiopian studies, Ethiopian bodies have been theorized as mere territories of rites of passage or 'social skins' of a 'primitive' ethnic group who are devoid of their own dynamic subjectivities as functions of pre/modern power relations. Coupled with and making use of Cartesian thinking (binarism of body/mind), the

old Semitic thesis sends non-Abyssinian Ethiopian bodies, gendered and sexed women and men, classed subjects, disabled people, cast groups, and others to a different time zone that "lags" behind the Ethiopian state's projects of modernity. The uncritical/conventional view on bodies also reproduces the old patterns of marginalization even when it attempts to 'include' bodies who inhabit the margins of the Ethiopian state.

Principal Investigator: Dr. Surafel Wondimu

Members:

1. Dr. Desalegn Amslau
2. Dr. Hiruy Abdu
3. Tirsit Sahledengel (PhD candidate)
4. Nuraddin Aman (PhD Candidate)
5. Eyerusalem Kassahun

Evidence-based Watershed Development for Sustainable Agricultural Development in the Highlands of Ethiopia

Executive Summary

In spite of its huge available agricultural resources, Ethiopia is recorded as number one country in the world to be severely affected by land degradation and famine. Historically, its agricultural land resources have been misused and over used. This process has caused the decline of the quality of the land resources as a consequent of which land productivity and general ecosystem services declined. The forest resources of the country which had been estimated to cover over 90% of its highlands, which is reduced to less than 3% in 1990s and slightly raised to 10% in 2010s. Severe soil erosion has occurred following the destruction of the forest and natural vegetation

cover of the country. Connected to this, available water both in quantity and quality as well as wild animal resources have been significantly degraded. The process has resulted in lowering agricultural productivity and thereof shortages of food crop availability to the population of Ethiopia. The problem is exacerbated by occurrences of series of drought in different periods across the country.

In order to overcome the problems, the government of Ethiopia (GOE) has introduced different strategies of natural resources management and increasing agricultural productivity. As part of this strategy, watershed development and plans have been initiated since 1970s and implemented but showing low achievements. The improvement of the quality of natural resources (e.g. soil, water and forest) and its impact on productivity could not be achieved in a short period as envisaged in many watershed development documents of the country. Therefore, this project is designed to study impacts of watershed development plan and its implementation on natural resources, sustainable agricultural development, climate change adaptation/ mitigation and assess gaps of watershed development plan for policy improvement.

Principal Investigator: Prof. Mohammed Assen

Members:

1. Prof. Dereje Ayalew
2. Dr. Degifie Tibebe
3. Mohammed Endrias
4. Dr. Assefa Abegaz
5. Mathias Tesfaya

COLLEGE OF VETERINARY MEDICINE & AGRICULTURE

Indigenous/Village Chicken Production in Selected Sites of Central Ethiopia: Assessment of Production and Marketing Systems, Investigation of Major Diseases and Phenotypic characterization, implications for further genetic improvement and utilizations

Executive Summary

Animal production in general and chicken production in particular plays important socio-economic roles in developing countries. Nearly all rural and peri-urban families in developing countries keep a small flock of free range village chickens. Approximately 80% of the chicken populations in Africa are reared in free scavenging systems. Smallholder farming families, landless laborers and people with incomes below the poverty line are able to raise chicken with low inputs and harvest the benefits of eggs and meat via scavenging feed resources. In most African countries, the rural chicken population accounts for more than 60% of the total national chicken population. The proportional contribution of poultry to the total animal protein production of the world by the year 2020 is believed to increase to 40%, the major increase being in the developing world. However, most communities lack the required husbandry skills, training and opportunity to effectively improve their household chicken production. In Ethiopia, chickens are widespread and almost every rural family owns chicken, which provide a valuable source of family protein and income. The total chicken population in the country is estimated at 38.1 million. The majority (99%) of these chickens are maintained under a traditional system with little or no inputs for

housing, feeding or health care. The most dominant chicken types reared in this system are local ecotypes, which show a large variation in body position, colour, comb type and productivity. The greater part of the feed for village chicken is obtained through scavenging, which includes the household cooking waste, cereal and cereal by-products, pulses, roots and tubers, oilseeds, shrubs, fruits and animal proteins. Rural chicken in Ethiopia represents a significant part of the national economy in general and the rural economy in particular, and contribute to 98.5% and 99.2% of the national egg and chicken meat production, respectively. However, the economic contribution of the sector is still not proportional to the huge chicken numbers, attributed to the presence of many technical, organizational and institutional constraints. Despite their low productivity, indigenous chickens are known to possess desirable characteristics such as thermo-tolerance, resistance to some diseases, good egg and meat flavor, presence of hard egg shells, high fertility and hatchability as well as high dressing percentage. However, little research and development works have been carried out on indigenous chicken, despite the fact that they are more numerous than commercial chickens in most developing countries and they have been marginalized by decision-makers. It is difficult to design and implement chicken-based development programs that benefit rural people without understanding village chicken production and marketing systems. Proper understanding of village chicken functioning and marketing structure are a prerequisite for developing market opportunities for rural households and could be used to inform policymakers and development workers in considering the commercial and institutional environment in which village chicken keepers have to operate. Studies on marketing of free range chicken can also provide clues for management strategies of these chickens especially in reducing chicken losses that smallholder farmers experience annually due to the threat of

diseases, especially Newcastle Disease. Concrete information about village chicken production and marketing systems study is highly required to characterize, conserve and improve the indigenous chicken genetic resource and to justify resource allocation to rural poultry improvement and conservation projects. Generally, in order for decision-makers to address poultry related challenges in production and marketing and to improve the nutrition, food security and livelihood of rural households by enhancing the benefits from poultry through appropriate production and marketing extension, it is essential to generate appropriate technologies which are socially acceptable, environmentally sound and economically feasible. The main advantages of chicken marketing research are defining the needs and nature of customers and their ability and desire to buy, scanning the business environment, gathering needed information for decision-making, reducing risk, helping in production planning and monitoring and controlling marketing activities. Access to markets affects the price and transaction costs and is influenced by access to infrastructure and information. Although there are some studies conducted on characterization of chicken production systems in some locations in Ethiopia, they are not comprehensive enough and did not relate production and productivity with marketing. Some of these studies were also site-specific. Characterization of the prevailing chicken production and marketing system is therefore an essential prerequisite to bring this into effect. Therefore, this thematic research proposal is developed with the objectives of studying major diseases of indigenous chickens, characterization of scavenging chicken production systems and identifying associated constraints as well as marketing systems from central highlands of Ethiopia.

Principal Investigator: Dr. Dinka Ayana

Members:

1. Prof. Hagos Ashenafi
2. Dr. Hika Waktole
3. Dr. Hana Zewdu
4. Dr. Waktole Terefe
5. Dr. Ketema Bogale
6. Ms. Berhane Wakjira
7. Dr. Habtamu Teshome
8. Dr. Hundura Sori
9. Mr. Debella Taweya
10. Dr. Solomon Mekuriaw

Biological Control of Nematode Parasites in Ruminants: application of non-pathogenic fungi as an alternative to anthelmintics

Executive Summary

Over the last 25 years, the Federal Government of Ethiopia has prioritized the transformation of the agricultural sector. In this, the comprehensive livestock master plan (LMP) of the country sets out investment interventions—better genetics, feed and health services, which, together with complementary policy support—could help meet the Growth and Transformation Plan (GTP) II targets by improving productivity and total production. However, the country is not benefiting adequately from its huge livestock potential because of many factors. Animal disease is one of the major constraints limiting the production of indigenous stock and hence their contribution. For ruminants reared on grazing systems, gastrointestinal parasite infections represent the class of diseases with the greatest impact on livestock health and productivity. Chemical control using

anthelmintic drenches has been a reliable means of helminth parasite control for the last 50 years. However, the extensive use of these anthelmintics over many years has often resulted in the development of resistance that has become a major practical problem in many countries of the world including Ethiopia. As a result of this failure of anthelmintic drenches, a major research effort has been underway for the past 25 years to examine alternatives to chemical control. The objective of this research proposal is therefore to isolate nematophagous and nematode trapping fungi from various environments of Ethiopia and produce an alternative medication (bio-control product) towards the control of major nematodes of ruminants.

The use of biological control methods such as nematode trapping fungi has now gained attention due to its promising results as an alternative to anthelmintic usage or its complementary effect. Biological control is a method in which biological agents can be used to reduce the populations of parasites either on pasture or in the host and by so doing minimize the frequency of anthelmintic usage. One example of biological control against gastrointestinal nematodes is the use of some species of nematophagous fungi with the potential to reduce nematode larval populations on pasture. Soil harbors a diverse range of fungi and many of them are rivals of nematodes. At the same time, many economically important nematode parasites of livestock spend much of their life cycle in soil, foliage, or dung. Ecological surveys of nematophagous fungi suggest that this group has extensive worldwide distribution, in all climates and habitats examined. Therefore, it can be relatively easy to isolate nematophagous fungi, particularly from soils and organic matter.

In this regards, the project attempts to achieve its goal of producing an effective biological control formulation against

major nematode parasites of sheep, goat and cattle in two different phases. Phase (I) identifies and propagates the major parasites from animals and isolates, characterizes and cultures effective nematophagous fungi from soils. Phase (II) tests and establishes the efficacy of selected nematophagous fungi both experimentally and under pilot treatment trial. For this study, standard epidemiological, parasitological, microbiological and molecular techniques will be employed. Soil, fecal and worm samples and epidemiological data will be collected from different geographical locations such as Gambella, Afar and Somali regional states representing hottest lowland areas, and from high land and mid-land areas of the Oromia, Amhara, SNNP and Tigray Regional states at the same time.

At the end of the study, at least two different fungal products with proven efficacy are expected to be delivered and ready to be used. A protocol for mass production and dispatch of fungal formulations will be developed, patent certificates obtained for the new product from the national authority, a series of trainings given to frontline stakeholders on the use and application of the new product, at least 20 manuscripts published in reputable international journals and six PhD, 18 MSc and 15 DVM students attached for their research works. The outcomes of all these will be improvement of livestock productivity by using cost effective organic biological control agent as alternative to chemical treatments such as anthelmintics against which resistance has already been reported from many places. This will ultimately reduce foreign currency expenditure for anthelmintics and promotes meat exports by avoiding chemical residues in such animal products. Once the product is proven to be effective, then a linkage with relevant industries will be created to facilitate transfer of the technology.

Principal Investigator: Dr. Getachew Terefe

Members:

1. Hika Waretole (PhD)
2. Gezahegne Mamo (PhD)
3. Gebeyehu Goshu (PhD)
4. Samson Leta (PhD)
5. Muluken Tekele
6. Tigist Gizachew

Investigation on Major Food and Vector Borne Zoonotic Diseases of Economic Importance and Determination of Antibiotic Residue and Antibiotic Resistance Profile of Food of Animal Origin in Ethiopia

Executive Summary

Food and vector borne zoonotic diseases are among the most widespread global public health problems of recent times, and their implication for health and economy is increasingly recognized. However, the true incidence of food and vector borne zoonotic illnesses are unknown for a number of reasons, including poor responses from victims during interviews with health officials, misdiagnosis of the illness, inadequate collection of samples for laboratory analysis and improper laboratory examination. The presence of various pathogenic bacteria, viruses, parasites and antibiotic residues in different foods poses a health hazard and raises concerns about the safety of these food products. Food borne illness is a major limitation to the advancement of world health and it is a growing public health problem in developing as well as developed countries and results from consumption of food containing pathogens such as bacteria, viruses, other parasites or the food contaminated by poisonous chemicals or bio-toxins. Bacterial pathogens are

among the leading causes of food borne illnesses and include *Escherichia coli*, *Campylobacter*, *Salmonella*, *Staphylococcus, Bacillus cerus*, *Bacillus anthracis* and *Listeria*. Many factors could be involved in contamination, including environment, human and animal contact. Leishmaniases is a parasitic disease which is notably characterized by development of visceral, cutaneous, and mucosal forms. The disease is widespread in the world, and still constitutes a major public health problem, causing considerable morbidity and mortality both in human and animals. In Ethiopia, a number of cutaneous leishmaniases manifest with localized cutaneous nodular lesions; besides this it has left many of its victims deformed and disfigured and stigmatized due to the dreadful scars they leave behind after healing.

Despite the fact that food and vector borne zoonotic diseases and antibiotic residues could result in significant public and economic problems, there is paucity of data in the study areas. Therefore, this project proposal is generally aimed to study major food and vector borne diseases of economic and public health importance, associated risk factors and to investigate on antibiotic use in food animal through One Health approach in Ethiopia.

This project will be accomplished through the application of questionnaire survey, bacterial isolation and identification, antibiotic susceptibility test, molecular characterization of the isolates, antibiotic residue analysis, *Leishmania* screening tests, serological tests, *Leishmania* culture, and histopathological methods using cross sectional study design. The output of this research will contribute to the ultimate reduction of hunger and poverty through enhancement of livestock production/productivity and improve the public health status of the communities at large. This research will be implemented through multi-sectoral and multi-disciplinary involvement. As

Ethiopia's new economic policy directed in promoting the international livestock trade through export of live animals and by product of livestock, the widespread prevalence of food and vector borne zoonotic diseases without any control strategy is one of the major obstacles for restriction of this international livestock trade opportunity to the world market. Moreover, the habit of consumption of raw animal products such as raw meat and milk, the close physical contact between animals and their owners particularly in pastoralist areas, the existence of a number of environmental and host risk factors for infections and transmissions, coupled with absence of sustainable disease control strategies at a national level are contributing factors for the wide spread occurrence of these food and vector borne diseases as a public health hazard in the human population. Moreover, the output of this thematic research project will ultimately support the effort to control important livestock diseases and promote the economic contribution of the livestock sector to the country. A minimum of 11 PhD, 18 MSc and 20 DVM students will be supported for their dissertation/thesis research works, which will have a great contribution to manpower development of the country.

Principal Investigator: Dr. Gezahegne Mamo

Members:

1. Dr. Kebede Amenu
2. Dr. Teshale Sori
3. Dr. Dinka Ayana
4. Dr. Beresessa Kumsa
5. Dr. Balako Gumi
6. Dr. Berehanu Abera
7. Dr. Dereje Wakjira
8. Dr. Girma Kebede

Unraveling the Epidemiology of Major Emerging Respiratory Viral Diseases in the Equids of Ethiopia: Towards the development of protective vaccines and designing integrated disease control strategies

Executive Summary

Working equids (horses, mules, and donkeys) have a great significance in the development of Ethiopia, where they have an essential role in reducing poverty, providing food security, enhancing rural development, and promoting gender equity across the globe. These animals are especially important to vulnerable groups, landless communities, and to women, where they can provide an effective entry point to income-generating activities. Numerous infectious diseases negatively impact the health and productivity of working equids. However, there are limited or no data quantifying the occurrence, prevalence, and distribution of many infectious diseases in the working equids of Ethiopia. Respiratory diseases are consistently ranked amongst the top three health problems in the working equids of Ethiopia. Multiple causative agents may be involved; however, viral pathogens play a significant role in establishing equine respiratory diseases. Among the OIE-listed viral diseases, African horse sickness (AHS), equine herpesvirus-1 (EHV-1), equine herpesvirus-4 (EHV-4), equine arteritis virus (EAV), and equine influenza virus (EIV) are the most important infectious respiratory diseases that have a significant socioeconomic impact to the equine industry. Despite their importance, studies on the epidemiology and genetic characteristic of respiratory viruses in the Ethiopian working equids as well as the ways the diseases are managed by farmers or owners are limited. Thus, understanding of the factors that influence the development, frequency and distribution of these emerging viral diseases and

their genetic diversity is helpful to develop reliable diagnostic techniques, effective therapies, and appropriate control strategies. In recent years, AHS is becoming a priority problem in working equids of Ethiopia despite regular vaccination practices using trivalent AHSV vaccine produced by the National Veterinary Institute (NVI) of Ethiopia. According to the report, the currently available vaccine against AHSV does not reliably provide full protection. Thus, by considering the various serotypes of AHSV and absence of cross-protection among the different serotypes, there are strong recommendations to use polyvalent vaccines incorporating the dominant circulating serotypes in the country. Therefore, this research work will be focusing on identification of the dominant AHS virus serotypes prevailing in Ethiopia and other possible determinant factors that challenge the efficacy of the existing vaccine. Moreover, identification of the *Culicoides* species in a given area and their breeding sites are important and necessary prerequisites for effective management and designing effective AHS control programs.

In Ethiopia, EHV-1/4, EAV, and EIV are emerging respiratory viral diseases of working equids. Previously, we studied the epidemiology of equine herpesviruses and equine arteritis virus. These studies revealed the existence of highly virulent strains of these viruses. However, data gaps still exist and more investigation needs to be done to better understand the molecular epidemiology of the viruses in the different geographical settings and equine populations. The analysis of this molecular data is very crucial in order to design more effective intervention strategies. At present, there is no vaccine available against equine viral respiratory pathogens such as EHV-1, EHV-4, EAV, EIV in Ethiopia and outbreaks of these viral diseases are controlled by proper management adaptations. Because the efficacy of currently available vaccines against

EHV-1, EAV, and EIV have never been evaluated, it is not clear to what degree they may give protection in Ethiopian horses, donkeys and mules. Thus, more work is needed to get an answer to these questions. The other research gap needed to be filled is the socio-cultural aspects of equine respiratory disease management such as indigenous practices and level of use of conventional/modern veterinary practices. The grand total budget estimated for this thematic research is 2,640,000 ETB.

Principal Investigator: Dr. Haileleuel Nigussie

Members:

1. Easayas Gelay
2. Daniel Gizaw
3. Hana Zewdu
4. Zerihun Asefa

Efficacy Evaluation of Current and Past Ethnoveterinary Medicines: Development of Alternative Therapeutics to Improve Livestock Health and Food Security Concern in Ethiopia

Executive Summary

Human health is highly inter-dependent upon the livestock health. The health of livestock owned by subsistence farmers in low-income countries is a key determinant of the sustainability of their livelihoods. Despite the importance of livestock, the productivity of this sector in Ethiopia is low compared to the African average. A key problem is the presence of a wide range of livestock diseases, which is worsened by lack of modern

veterinary services, particularly in rural areas. For this purpose, livestock owners use ethnoveterinary medicines (EVM) as well as easily accessible poor or unknown quality conventional veterinary medicines to treat various livestock illnesses. The use of traditional medicine in Ethiopia has significant importance as most of the population residing in the rural and peri-urban areas use these medicines. Among EVM, medicinal plants and other alternative therapeutics, like honey offer great prospects for development of novel chemotherapeutic agents and antimicrobials. These EVMs can possess both medicinal values as well as toxic adverse effects when given to patients through the oral route, apart from using for cutaneous diseases. However, the pharmacological, toxicological, immune modulating, production-enhancing activity of EVMs is not well documented and requires further investigation. Furthermore, animal health experts claim that veterinary drugs with poor quality and/or counterfeited ones are circulating in the local market that could contribute to treatment ineffectiveness. Under certain circumstances, the use of EVM may be more appropriate than use of conventional medicines, as the extensive misuse of certain potent conventional medicines, for instance antimicrobials, could lead to the development of microbial resistance and residues in food of animal products with resultant negative effects on public health. Besides, the cost of conventional medicines is often not justified by their therapeutic benefit. The use of low-cost EVM with known efficacy and safety can, therefore, be more appropriate even if conventional medicines with greater potency are available. Furthermore, pharmacological, toxicological, immune modulating studies of EVM that will assess the safety and promote it for healthcare use by livestock owners in Ethiopia is limited. To our knowledge, there are no published research results from studies conducted in Ethiopia on the dosage regimen standardization of EVM to improve their therapeutic efficacy and reduce the

toxicity risk to animal health. In addition, many veterinary drugs, specifically antimicrobials and antiparasitic agents, available in the local market were claimed to be low in quality as well as ineffective to treat livestock diseases. Henceforth, an in-depth study that evaluates the efficacy of varied brands of conventional veterinary drugs circulating in the Ethiopian market, assess the knowledge and practice of traditional healers, documents on the EVM used to treat infectious diseases of livestock, and further integrates these EVM into the modern medicine through pharmacological, toxicological, and chemical analysis, has paramount importance. This will lead to active, novel, effective, safe, affordable, and accessible products. Standardizing the dosage regimen of promising EVM in animals is the best approach to minimize the risks of toxicity and to reduce antimicrobial/drug resistance development.

This thematic research project contains three sub-themes. Sub-thematic research (STR) 1 deals with quality and efficacy evaluation of different brands of veterinary drugs; Sub-thematic research (STR) II deals with pharmacological activity evaluation of EVMs traditionally used in treating economically important livestock diseases, and Sub-thematic research (STR) III deals with dosage regimen standardization of promising EVMs and product development. Overall, this research can help to evaluate the efficacy of commonly used veterinary drugs, identify and list by priority the pharmacological and toxicological activity of EVM traditionally used to treat mastitis, trypanosomosis, and endo-ecto-parasitosis, immunomodulating and production enhancing activity of phytogenics in chicken that would lead to the development of new modern drugs for the treatment and/or control of economically important major livestock diseases. This research will be implemented via the involvement of multi-sectoral, multi-disciplinary and multi-institutions to improve the university-industry linkage and veterinary medicines-food

security linkage as well. During the entire project implementation over three years, the study will be conducted in selected districts from central, southern, and western areas of Ethiopia. Both cross-sectional and experimental study designs will be used. Conducting these all activities will give a foundation towards developing new effective and affordable medicines used to treat major economically important livestock diseases and to overcome the problem of drug resistance. They also enable us to develop capacity and recommend intervention strategies to improve treatment efficacy and mitigate traditionally used alternative medicines associated animal health consequences to address the national animal health program. The outcome of the project will be disseminated to the public using electronic public media and publications, workshop, and training. For the implementation of the project, the estimated budget is 2,430,500.00 ETB.

Principal Investigator: Dr. Takele Beyene

Members:

1. Prof. Fekadu Regassa (DVM, PhD)
2. Dr. Fikru Regassa (DVM, MSc, PhD; Associate Prof.)
3. Mrs. Berhane Wakjira (DAH, BSc, MSc; Lecturer)
4. Dr. Fanta Desissa (DVM, MSc, BSc, MSc; Associate Prof.)
5. Mr. Dereje Nigussie (B. Pharm, MSc; Senior Researcher)
6. Dr. Hayat Seid (DVM, MSc)
7. Dr. John Buchweitz (PhD, Assistant Professor)

Optimizing Dairy Herd Structure and Performance by Increasing Dairy Replacement Heifers, Application of Selected Assisted Reproductive Techniques and Sexed Sperm

Executive Summary

The availability of genetically desirable replacement heifers are among factors that significantly influence the sustainability of many dairy enterprises in Ethiopia as cost of dairy heifers are severely increasing from time to time.

One way of tackling such problems should be use of sex-sorted semen which easily allows farmers to significantly skew the sex ratio of their animals' offspring, so herd size is no longer limited by balancing the need for an adequate supply of replacement heifers. Sexed sperm will also accelerate genetic gain, and improve herd biosecurity. Additionally, fewer cows would be required to produce daughters of high genetic merits at large number when sexed sperms would be used with other assisted reproductive technologies like in vitro embryo production (IVEP), and greater opportunity would exist for cross-breeding of even older, genetically inferior cows, all of which would lead to a steady supply of genetically superior replacement heifers. Maximizing reproductive efficiency depends upon the successful completion of many events among which are manipulations of reproductive-related events and/or structures, ovulation synchronization (Ovsynch/Co-synch), fixed time artificial insemination (FTAI) with sex-sorted sperm, intracytoplasmic sperm inoculation (ICSI), and in vitro embryo production (IVEP) to maximize reproductive efficiency and to increase replacement heifers in dairy farms.

The details of the techniques of each action in different sub-thematic researches (STRs) are described. In part one of this research, series of experiments will be conducted to optimize the time of insemination for sexed sperm first to

develop guidelines for the use of sex-sorted sperm in association with TAI protocols in local (*Bos indicus*) and crossbred (*Bos indicus* X Holstein) dairy cattle. We believe that the optimal interval for timed AI with non-sorted or conventional sperm should not be used for sorted sperm as it may not be compatible with the use of sex-sorted sperm for several reasons, including the potentially reduced lifespan of sex-sorted sperm in the female reproductive tract, fewer numbers of sorted sperm/straw, and possible pre-capacitation induced by the sorting procedure. In the subsequent experiments of part two, sexed sperm will be used at farm level to produce dairy heifers based on developed guidelines.

In part two of this research, series of experiments will be conducted using combinations of gonadotropin release hormone (GnRH), progestogens (progesterone releasing intravaginal device (PRID)/controlled internal drug release (CIDR)/(MGA), prostaglandin F2alpha (PGF2α), gonadotropins, and estrogens (estradiol benzoate/estradiol cypionate) to have pregnancy rates ranging at least from 50 to 75%. The research plans to remove the necessity of estrus detection (especially at smallholder resource poor farms where heat detection will be compromised severely by many factors) by applying a fixed time breeding.

In part three, first a thorough assessment of the biological and managerial causes of repeat breeding including herd health, individual animal infertility and management factors. Then series of treatments will be conducted to improve fertility and pregnancy. To attain these objectives we will control the ovarian activity by exogenous hormonal interventions on luteal and follicular development for the treatment of conditions, to increase in the size of the pre-ovulatory follicle to generate a larger corpus luteum that maintain pregenancy, and hormonal therapy for repeat breeding. Hormonal treatments would also be used to try and improve embryo survival after AI.

Principal Investigator: Dr. Terefe Yilma

Members:

1. Prof. Fekadu Regasassa
2. Prof. Alemayehu Lemma
3. Dr. Telaye Demessie
4. Dr. Tamirat Degefa
5. Dr. Hika Waktole
6. Fayo Dubissa
7. Abiye Shemelis
8. Kefelegne Seyoum

Safeguarding Public Health through Assessment of the Level of Contamination by Salmonella spp., Campylobacter spp. and E. coli and Antimicrobial Residues of Poultry and Poultry products in Central Ethiopia

Executive Summary

Chicken production plays an essential role in poverty alleviation and social development throughout Ethiopia. Data from central statistical agency of Ethiopia showed that approximately 57% of the rural and urban households (8,790,601 of 15,479,493 households) in the country keep poultry and their livelihood is directly or indirectly dependent on poultry production. As the demand for food rises due to a growing population, the Ministry of Agriculture targeted upgrading of chicken production with the aim of raising chicken meat and egg production. As a result, the number of poultry firms of all sizes has been increasing. Similarly, the number of shops and retailers handling and selling chicken meat and eggs has risen currently. Shops and retailers handling chicken meat and eggs became numerous in central Ethiopia including Adama, Bishoftu, Dukem, Sebeta, Addis Ababa and the surrounding towns. The growing urbanization and the influx of people to urban centers will further increase the demand for poultry products, which many people can afford. Unless there is control of the level of

contaminants, the poultry products could be source of food-borne zoonotic diseases to humans.

As there is no regular monitoring and intervention on the use of antimicrobials in the country, the poultry farmers do not comply with the withdrawal periods of the antimicrobials. This would be responsible for accumulation of drug residues in poultry meat and eggs. If the residue levels become higher than the maximum residue level recommended, they can cause various complications in humans. In addition, since the use of antimicrobials is not based on the prescription of veterinarians, the amount of the drugs may not be sufficient to eliminate the bacterial pathogens they are intended to treat. Such misuse of drugs can lead to development of resistance in those bacteria against the commonly used antimicrobials, which would complicate the public health intervention activities.

The extent of inadvertent use of antimicrobials and the poor hygienic level of handling poultry and poultry products might even be aggravated under smallholder and family poultry production systems. Unhygienic handling and lack of knowledge on withdrawal of antimicrobials from poultry products is likely to put consumers' health at risk. It is hypothesized that understanding of the sources of the contamination, the level of contamination and

points of high risk along the chain of poultry products by zoonotic bacteria and antimicrobial residues is important for targeted intervention to reduce the load of zoonotic bacterial and the level of antimicrobial residues in poultry and their products. This thematic research will provide information on some of these aspects through understanding of the sources of contamination of poultry products by *Salmonella* spp., *E. coli* and *Campylobacter* spp. In addition, it will provide information on the level of contamination of poultry products by these zoonotic bacteria and estimate the level of antimicrobial residues in poultry and poultry products.

Principal Investigator: Dr. Teshale Sori

Members:

1. Haileleul Negussie
2. Debebe Ashanafi
3. Asaminew Tesfaye
4. Gezahegn Mamo
5. Zerihun Aseffa
6. Dejene Tadesse
7. Bersissa Kumsa
8. Bedaso Kebede
9. Megersa Beda

Investigation of Major Transboundary Animal Diseases Affecting Export Trade and Improvement of Healthcare Decision-making and Veterinary Medicinal Products Usage Reporting System in Ethiopia

Executive Summary

Ethiopia is reported to be endowed with the largest livestock population in Africa, estimated to 59.5 million in 2018. Cattle production plays an important role in the economies of farmers and pastoralists and the country at large. Ethiopia is attaining significant outcome from the export of livestock products, and has been contributing crucial role in the development of the national economy. During the past fiscal year, the country earned 112.7 million dollars in exports from livestock, mainly sending live-animals to the Gulf States. However, due to low productivity and high prevalence of livestock diseases, the contribution of livestock to foreign exchange earnings has not attained the desired levels. The livestock exports have suffered from repeated trade bans due to importing countries' concerns over transboundary animal diseases (TADs). Ethiopia has a variety of livestock diseases that affect international trade; These are Rift Valley Fever (RVF), foot and mouth disease (FMD), contagious bovine pleuropneumonia (CBPP), contagious caprine pleuropneumonia (CCPP), peste des petits ruminants (PPR), brucellosis, and

lumpy skin disease (LSD). However, there are limited or no data quantifying the occurrence, prevalence, and distribution of these major TADs in the Ethiopian cattle. In addition, TADs cause high rates of death and disease in animals, thereby having serious socio-economic consequences while constituting a constant threat to the livelihoods of livestock farmers, food security and public health. Despite their importance, studies on the epidemiology, genetic characteristic of these major TADs, and their control strategies in the Ethiopian cattle as well as the ways the diseases are managed by farmers or owners are limited. Thus, understanding of the factors that influence the development, frequency and distribution of these TADs and the genetic diversity of pathogens is helpful to develop reliable diagnostic techniques, effective therapies, and appropriate control strategies. In Ethiopia, informal cross-border livestock trade has long operated in pastoral areas and makes a significant contribution to regional and national economies, as well as local livelihoods. Communities living in Ethiopian borders have long benefited from sharing natural resources and economic exchanges. However, along with these cross-border animal movements, many TADs get unrestricted opportunity to circulate between the neighbor regions or countries. To minimize risk of disease incursion, it is necessary to understand the potential entry points and pathways to exposure of a pathogen and the socio-cultural

aspects of TADs management such as indigenous practices and level of use of conventional/modern veterinary practices.

Principal Investigator: Dr. Yasmin Jibril

Members:

1. Dr. Yitbarek Getachew
2. Dr. Fanos Tadesse
3. Dr. Daniel Gizaw
4. Dr. Belayneh Getachew
5. Dr. Haileleul Nigussie
6. Dr. Takele Abayneh
7. Dr. Liyuwork Tesfaw
8. Dr. Molalegne Bitew
9. Dr. Aberham Ali
10. Dr. Redeyel Belayneh

Enhancement of Poultry Production through Breeding and Inclusion of Feed Additives, Reproduction of Poultry Farming Public Health Risks and Economic Determination of Family Poultry in Food Security Efforts

Executive Summary

This project focuses on enhancement of poultry production and productivity through improved management, breeding and inclusion of feed additives, and reduction of public health risks

caused by poultry farming.

Chicken meat and egg production, product quality and backyard chicken production practices and productivity of small scale broiler, dual and layer chicken meat and egg producers will be evaluated. Furthermore, the value chains of meat and egg production will be analyzed to identify the bottleneck of the systems. In addition baseline data on adoption and some vital blood parameters (haemato-biochemical profiles) of exotic chicken breeds will be assessed in Ethiopia. Characterization of indigenous chicken ecotypes and evaluation of different protocols of indigenous chicken breed's semen cryopreservation will be done. In this project, on-farm and on-station phenotypic characterization of indigenous chicken ecotypes in selected regions of Ethiopia will be analyzed. Furthermore, the reproductive performance of indigenous Horro breed and Gambella chicken ecotype will be evaluated by using different breeding practices. Phytogenic feed additives on egg production and reproductive performance, anti-microbial effects, immune-modulatory activities will be evaluated on commercial layers. Major poultry diseases and their economic and public health significance will be analyzed. Risk analysis of transmission dynamics of poultry diseases between chicken and human population will be done. This project will be accomplished through the application of questionnaire survey,

on-station and on-farm evaluation of chicken production performance, pathogen isolation and characterization, laboratory analysis of semen, chicken trial, partial economic significance and disease risk analysis. The output of this research will contribute to the ultimate reduction of hunger and poverty through enhancement of poultry production/productivity and improve the public health status of the communities at large. This research will be implemented through multi-sectoral and multi-disciplinary involvement. Although Ethiopia's livestock master plan is directed towards increasing egg and chicken meat production through adoption of technologies, breeding and improvement of management practices and disease prevention and control, the existing poultry sector is facing challenges that hinder the success of the plan.

These challenges facing the poultry sector are low adoption status of poultry technologies, lack of improved management (feed, housing and health care) and lack of identification, characterization of indigenous chicken breed/ecotypes, lack of exploitation of local feed additives resources, lack of awareness on zoonotic diseases and their prevention methods and lack of baseline data on production performance. Moreover, the output of this thematic research project will ultimately support the effort of the government to improve the poultry industry. A total of 6 PhD, 9 MSc and 9

DVM students will be supported for their dissertation/thesis research works, which will have a great contribution to manpower development of the country.

Principal Investigator: Dr. Gebeyehu Goshu

Members:

1. Prof. Berhan Tamir
2. Dr. Ashenafi Mengistu
3. Dr. Gezagegn Mamo
4. Dr. Tewodros Eshete
5. Dr. Tesfaye Engida
6. Dr. Behailu Asefa
7. Dr. Abebe Gemechu
8. Dr. Tekalegne Getachew
9. Dr. Getachew Bekele

Improving Meat and Carcass Quality: Identification and characterization of major pathological lesions, pathogens and foreign bodies causing organ/carcass condemnation in food animals, assessing economic impacts and public health risks and devising intervention strategies in central, south east and west Oromia (FAP-TR)

Executive Summary

Animals and animal resources in Ethiopia occupy a very special place in poverty reduction programs as in many African countries. The livestock sector in Ethiopia contributes 20% and 45% of the total and agricultural Gross Domestic Product (GDP), respectively, and provides livelihoods for 65% of the population. Studies conducted so far in different parts of Ethiopia indicated the importance of pathogens as causes of reduced quality of animal products resulting in significant financial losses. Abnormal growths/anomalies in slaughtered animals at export and municipal abattoirs, poultry slaughter houses as well as fishery areas were totally neglected. Causes of chicken and fish carcass condemnation were not reported so far in Ethiopia. Previous studies did not fully address characterization and the impact caused by various pathological lesions, most of which such as malformation are totally neglected. Thus, the

thematic research project team plans to gather data on the gross and microscopic characterization of pathological lesions as well as abnormal growths/anomalies and their role in organs and carcass condemnation targeting different anomalies and atrophy of organs and other abnormal growths; lesions: tumor, abscesses, calcifications, hepatization, hematoma, bruise, jaundice, granulomatous tissue growth, etc. The foreign bodies and lesions developed by foreign bodies are also considered in this project as main economic risks in Ethiopia due to increased urbanization and decrease in grazing lands in different areas of the country. The problem could be because of the several constraints that occur from farm level (health and husbandry problems), seasonality in production, development of infectious and non-infectious diseases in decreasing meat and carcass quality, problems in the production system, or a combination of several factors. Thus, it is imperative to identify the major pathogens and lesions as well as other risk factors contributing to affect the quality of meat and carcasses in food animals, poultry and fishes as well as in order to reduce public risk in central, south east and west Oromia that has hindered smooth functioning of the Ethiopian live animal and meat production sector and propose appropriate actions.

This thematic research project focusing on ‘Improving the quality of meat and carcass and

reducing public health risk through investigating major pathological lesions, pathogens and foreign bodies in food animals, poultry and fishes: morphometric and histopathological investigation, impact analysis and devising interventional strategies in central, south east and west Oromia. This thematic project has three sub-thematic researches. Sub-thematic research (STR) I deals with investigation of economically important pathological lesions and pathogens (bacterial, viral, parasitic etc...) in food animals; organ distribution, morphometric and histopathological studies. The team will focus on economically important lesions (cysts, tumor, abscesses, calcifications, hepatization, hematoma, bruise, jaundice and granulomatous tissue growth at export, municipal abattoirs, and food animals slaughter houses. Organ distribution of these lesions and abnormal growth and major pathogens will be identified. The team members will also conduct morphometric and histopatological studies. The collected lesion will be systematically classified, preserved and mounted for amelioration of histo-pathological and parasitological museums as well as will be used for teaching and demonstration purposes. Sub-thematic research (STR) II is concerned about investigation and characterization of foreign bodies (trichobezoars, pillobezoars, phytobezoars and foreign body bezoars); clinical and abattoir based studies. The scope of this sub-thematic research project proposal will be

assessment and characterization of pathological lesions developed by foreign bodies (Bezoars, pillobezoars, phytobezoars, etc...). The study will involve gross and histopathological examinations. Problems related with bezoars: pillobezoars, phytobezoars, etc. in urban and peri-urban areas will be investigated. Bezoars are known to cause obstruction, bloat and sudden death of food animals. The problem has not yet been investigated; the causative agents or objects are numerous and need to be morphometrically, histopathologically and chemically characterized. Detailed literature survey and participatory epidemiology (questionnaire survey using structured and pre-tested questionnaires, group discussion) as the data collection tools to generate the required inputs implying for the problems. Sub-thematic research (STR) III deals with assessment of the economic impact of major pathological lesions, pathogens and foreign bodies and devising cost effective intervention options. This team tries to determine the economic impact of identified pathological lesions, pathogens and foreign bodies in STR I and on marketability of edible organs, meat and carcasses. Calculation of financial losses due to organ/carcasses condemnation and best risk intervention/management options that potentially mitigate the financial losses and public health risks will be a focus of this sub-theme. The study will involve different recommended methodologies for estimation of the financial

loss. Detailed literature search and participatory approach, which involves questionnaire survey and focus group discussion will be used to generate different intervention options. The best cost effective intervention options will be identified using the multiple criteria decision tool (MCDA). These may include modern scientific intervention options that will be identified based on thorough literature search, expert opinion elicitations, and customized according to our local situations. The identified community KAP and modern based practices will be integrated and prioritized and will be used as a chosen final intervention tool.

The project brings together diverse expertise: epidemiologists, pathologist, GIS experts, field veterinarians, etc) and diverse organizations (AAU-CVMA, National animal health investigation and control center and Bishoftu municipality). The partnership has been developed based on expertise and previous experiences. The organization of the work/activities of the project will be aligned with the expertise of each institution involved as indicated in the "Description of action and its effectiveness" section. The integration of the activities in this project will finally lead to the development of disease prevention strategies and economic overgrowth with veterinary and public health importance. The disease management platform could support informed decision-making

for foreign body control and prevention and reducing different lesion development that causes organ condemnation.

Principal Investigator: Dr. Abdi Feyesa

Members:

1. Prof. Yacob Hailu
2. Prof. Brook Lemma
3. Prof. Fekadu Regassa
4. Dr. Jirata Sheferaw
5. Dr. Yasmin Jibril
6. Dr. Fenta Dissasa
7. Dr. Samson Letta
8. Dr. Megeresa Bedasa
9. Mr. Debela Taweya
10. W/ro Birhane Wakjira
11. Mr. Dereje Gudeta
12. Mr. Biruk Hailemikael

The Impact of Urban Livestock Production on Household Food Security, Child Nutrition and Health in the Central Highlands of Ethiopia

Executive Summary

Livestock have considerable potential to contribute towards improving food and nutritional security, enhancing agricultural growth, reducing rural poverty and mitigating

farm households' vulnerability to production shocks. Livestock can also generate a range of products and services, almost on a continuous basis, and the earnings from their sales can be utilized to meet households' daily consumption needs and other expenditures. Livestock production is less prone to external shocks such as droughts and floods, and therefore, they serve as a form of self-insurance for farm households. In mixed farming systems, livestock are largely raised on low-value crop residues or by products and common grazing lands, and thus livestock production is relatively less expensive. Higher income from the sale of animal products enables the households to improve their dietary diversity and children's health and nutritional status and reduce their stunting rates.

Urban livestock (dairy, poultry, beef and small ruminant) production is concentrated in and around major cities and towns of Ethiopia with a high demand for animal products (milk and milk products, eggs and meat). By supplying fresh milk, meat, eggs and milk products, urban livestock production, to a large extent, complements rural agriculture and increases the efficiency of national food systems. It is the best available source for the production of high biological value (animal protein) in terms of eggs and meat, milk and milk products and significantly contributes to household income, food security, child nutrition and health.

Food-secured households were associated with high livestock asset ownership, indicating the increased cash income primarily coming from livestock through the sale of live animals, milk, meat, hides and skins. The income obtained from sale of livestock, livestock products and by-products (hides and skins) is wisely used to finance the purchase of household commodities such as grains, salt, coffee, tea, salt, cooking oil, sugar, as well as meeting health expenses.

Food insecurity and/or malnutrition continue to be the major cause of morbidity and mortality in children in many developing countries. In Ethiopia for instances, child malnutrition is a serious problem. In Ethiopia, 44% of the children are chronically malnourished and about 57% of child mortality is under the age of 5 years old. The prevalence of malnutrition is said to be very high among children with wasting, underweight and stunting being 14.1, 35.9 and 44.4%, respectively.

Household food security, child nutrition and health could be affected by the household income, family size and types and productivity of agricultural activities. Food security has been defined as a condition that exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. It has been anticipated

that a 50 to 70% increase in food productivity will be needed by 2050 to feed an additional two billion people estimated to be added during this period to the global population. This is especially crucial for developing countries, where the problems of feeding poor people have been highlighted by recent food price shocks, which is further expected to continue to rise.

In Ethiopia, baseline data and information on the very role of urban livestock production and its impact on the household food security/food self-sufficiency status in general and child nutrition and health in particular are scanty. Also, the safety of these animal products with respect to food-borne diseases is of great concern in affecting human health, and in particular child health. This is especially true where production of milk, milk products, meat and eggs takes place under unsanitary conditions and poor production practices.

Ethiopia has a high rate of urbanization, averaging about 4.3% per annum. The increased rate of urbanization is accompanied with growing numbers of the urban poor and malnourished population including children, due primarily to the high rate of unemployment. Most cities and towns in Ethiopia have recognized urban livestock production as one of the important tools to reduce poverty and unemployment and to improve household food security, child nutrition

and health. To this end, the cities and towns have recognized and accepted urban livestock production as an integral component of the City's Development Master Plan and established the Department of Urban Agriculture at both city and sub-city levels.

As a result, urban livestock production is now playing a major role in creating job opportunities and becoming a source of income generation for most unemployed youth and urban dwellers and also expected to improve household food security and thereby satisfy the protein demand and child nutrition and health of the urban dwellers.

However, information on urban livestock production and its impact on household food security as well as child nutrition and health is scanty, mainly due to the very little attention given to it by researchers despite its significant contribution to the socio economic development. In addition, major constraints and opportunities of urban livestock production have not been assessed and identified for possible recommendations for further improvement of urban livestock production practices in the central highlands of Ethiopia.

A team of expertise comprised from the Department of Animal Production Studies (APS) and Department of Parasitology and Pathology (PAPA) of the College of Veterinary Medicine & Agriculture (CVMA) and the Center for Rural

Development of the College of Development Studies of AAU as well as the Ethiopian Institute of Agricultural Research (EIAR) at Bishoftu will accomplish the project. The team consists of one principal investigator (project coordinator) with an academic rank of Professor, and co-investigators of 1 Professor, 1 Associate Professor, 2 Assistant Professors, 1 Lecturer, 1 senior researcher and 4 PhD, 6 MSc and 4 DVM students.

This project will identify the impact of urban livestock production on household food security, child nutrition and health in terms of food availability, food access, and food utilization, height-for-age, weight-for-age, and weight-for-height, the stunting, underweight, and wasting prevalence rate and severity as well as morbidity and mortality of children under the age of 6 years in the central highlands of Ethiopia. The project will also identify constraints and opportunities; that livestock husbandry practices, feeding strategies and productive and reproductive performance of urban livestock production in the central highlands of Ethiopia. The project will also identify factors contributing to milk, egg and meat quality deterioration and measures towards product quality improvement in order to improve food safety and contribute to the improvement of household food security, child nutrition and health of urban households. The project will have

three years of lifetime (2019-2022) and will cost a total of 4,308,799.00 Birr.

Principal Investigator: Prof. Berhan Tamir

Members:

1. Dr Gebeyehu Goshu
2. Dejen Assefa
3. Mishra, V.K. PhD,
4. Prof. Hagos Ashenafi
5. Abate Mekuriaw, PhD
6. Lemma Zemedu, PhD

Ectoparasites and Associated Pathogens of Domestic and Wild Animals in Selected Districts in Ethiopia: diversity, impact on tanneries, georeferencing, in vitro and in vivo susceptibility to acaricides and medicinal plants to improve prevention and control

Executive Summary

Animals contribute to natural, financial, human, physical and social capital in different ways and to different degrees in all production systems in Ethiopia. Animals reared in all of these production systems are often infested by ectoparasites and vector-borne pathogens. Ectoparasites and vector-borne pathogens are one of the main constraints impairing animal

agriculture. Ectoparasites and vector-borne pathogens negatively affect the achievement of food security and the vibrant economic development of the nation. Ectoparasites and vector-borne pathogens are one of the most common and widely distributed in Ethiopia and contribute to major hindrances in productivity of animals in Ethiopia. Ectoparasites are one of the standing constraints impairing productivity and health of domestic animals in Ethiopia. Ectoparasites are very common and widely distributed in all agro-ecological zones and pose enormous economic and public health problems in the country. Ectoparasites such as ticks, mites, flies, fleas and lice also act as reservoirs and vectors for a wide range of human and animal pathogens worldwide and thus inject pathogens such as viruses, bacteria, protozoa and toxins in to their hosts. Recent reports show worldwide growing health risks associated with ectoparasites and their associated pathogens in both humans and animals. In Ethiopia, the methods of ascaricide application on animals include manual spraying, hand dressing and spray races. The chemicals currently used for ectoparasites control in the country are mainly organophosphates, carbamates, amidines or synthetic pyrethroids and it is essential to establish a system for the assessment of ascaricide resistance in arthropods. Efficient control of ectoparasites, therefore, requires understanding the in vitro and in vivo efficacy of the commonly used ascaricides.

Medicinal plants against ectoparasites infesting animals may be used as an alternative to chemical compounds. This study will try to explore the in vitro and in vivo efficacy of the commonly used ascaricides and medicinal plants against ectoparasites of animals. The outcomes will be used by the veterinary authorities to improve the prevention and control approaches of the most economically important parasitic arthropods of animals in Ethiopia. There is lack of precise and up-to-date comprehensive information on arthropods affecting domestic and wild animals in Ethiopia especially their diversity, their impact on tanneries, georeference, their seasonal dynamics and their zoonotic significance is not clearly known in Ethiopia. This thematic research will update species diversity of ectoparasites, impact on tanneries, zoonotic significance, georeference, in vitro and in vivo susceptibility to acaricides and medicinal plants with ultimate goal to improve prevention and control of ectoparasites of animals in selected districts in Ethiopia.

Principal Investigator: Dr. Bersissa Kumsa

Members:

1. Teshale Sori (DVM, MSc, PhD)
2. Fanos Tadesse (DVM,MSc)
3. Yonas Abiy (DVM, MSc)
4. Solomon Mosu (DVM, MSc)
5. Melkamu Tadesse (DVM)

6. Misgana Naramo (DVM, MSc)
7. Teferi Degefa (DVM, MSc)

Equine (Horses, Donkeys and Mules) Trypanosomosis in Ethiopia: socio-economic importance and constraints of equines keeping, epidemiology, molecular characterization and improving diagnostic and treatment options for future vaccine development

Executive Summary

The developing world contains an estimated 90 million equines (horses, donkeys and mules), with the highest concentrations in central Asia and North and East Africa. More than 95% of all donkeys and mules and 60% of all horses on earth are located in developing countries. In Ethiopia, as in many developing countries, agriculture plays a central role. Research has shown that about 82% of the economically active people in Ethiopia are farmers. The production of the average farmer consists of 60% crops and 30% livestock. Ethiopia accommodates a relatively high number of equines (horses, donkeys and mules). In 2006, the country had the fifth highest equine (horses, donkeys and mules) population and in 1996 it contained about half of Africa's population with 59%, 46% and 37% of

all African horses, mules and donkeys respectively. In Ethiopia, after bovines, equines (horses, donkeys and mules) appeared the most important animals for the farmer. Equines (horses, donkeys and mules) in Ethiopia are subjected to different diseases of which protozoan diseases caused by several pathogens among which trypanosomosis due to different species of *Trypanozoon* i.e. *T. equiperdum*, *T. evansi* and *T. b. brucei* responsible for the diseases, dourine, surra and nagana, respectively. In a developing country like Ethiopia, the contribution of equines (horses, donkeys and mules) in the sector of transportation and agriculture is of considerable significance. So far, there has been no single study conducted to assess the economic importance of equines (horses, donkeys and mules). Dourine is one of the major diseases of equines (horses, donkeys and mules) in the highlands of Ethiopia leading to ill health, suffering and early demise of the animal. Diagnosing the disease by standard parasitological techniques is difficult. Alternatively, serological tests and nucleic acid technologies such as PCR have become important in determining the disease status of individual animals. In Ethiopia, only a few fragmented studies were conducted with regard to dourine. However, none of the previous studies isolated the trypanosomes in the blood of dourine suspected animals. Owing to difficulties and challenges attached to the diagnosis of *T.*

equiperdum, it was not possible to achieve reliable data on the prevalence and distribution of the disease and above all for the implementation and monitoring of the disease control programmes. Hence, it was important to closely examine the comparative sensitivity of parasitological, serological and molecular tests for diagnosis and thereby determine the degree of test agreement among the tests used. Various trypanocidal drugs have been developed for chemotherapeutic and chemoprophylactic treatment of *T. evansi* and *T. brucei* infections in humans as well as animals. However, no extensive drug testing has been done for *T. equiperdum*, probably due to the eradication strategy imposed by the OIE. Moreover, no reports on clinical efficacy of the available drugs against *T. equiperdum* have been published. In Ethiopia, horses are treated against equine trypanosomosis on an irregular basis (when trypanocidal drugs are available) and even treated animals show frequent relapses. Thus, to prevent frequent relapses and maintain the efficacy of the available trypanocidal drugs, it is important that chemotherapeutic regimens are rationalized on the basis of the drug sensitivity of trypanosome strains in a given locality.

Principal Investigator: Prof. Hagos Ashenafi

Members :

1. Dr. Dinka Ayana

2. Dr. Kibeb Legesse
3. Dr. Hana Zewdu
4. Mr. Hika Waktole
5. Mr. Takele Beyene
6. Dr. Ketema Bogale
7. Mr. Alemu Tola
8. Dr. Zewdu Seyoum
9. Dr. Hundura Sori
10. Dr. Nesibu Awol
11. Dr. Bedaso Mamo

Improving Dairy Cattle Productivity: unravelling the epidemiology of emerging and reemerging infectious diseases of reproduction and feed related metabolic disorders, towards developing efficient intervention strategies to ensure food security and public safety

Executive Summary

Cattle production especially the dairy sector is contributing towards food security through increased incomes of dairy producers, creating employment and improved access to affordable protein rich diet at house level. Despite huge numbers of livestock population and significant contribution towards dairy producers as well as the country's economy, the attention given to the dairy cattle industry in Ethiopia is quite minimal. Efficient reproduction is critical for the economic

success of dairy industry. However, the dairy sector is still underdeveloped for several logistic and technical reasons including the preponderance of infectious diseases that impede the productive and reproductive performance of dairy cattle. Infectious diseases in dairy cattle pose threats to food security, food safety, national economies, biodiversity and the rural environment. Specially in developing nations like Ethiopia, reproductive inefficiency significantly affects the social security and livelihoods of the pastoralist and dairy farmers. Therefore, recognition, prevention, and efficient and efficacious treatment of reproductive diseases, based on the best available scientific information, are important for dairy producers and the country at large. Although there have been attempts to improve the reproductive efficiency of dairy cattle in Ethiopia, the incidences of reproductive diseases in dairy cattle have still been increasing over the years. The exact cause of this has not been evident and is often complicated by involvement of multiple causative agents. Thus, there is a need for a comprehensive multi-faceted approach to understand the correlation of various factors with reproductive performance of dairy cattle. Infectious agents are significant causes of reproductive disorders and are being given high priority in the dairy cattle industry in Ethiopia. Numerous infectious pathogens such as bacterial, viral and protozoal agents are known to have a direct impact on the reproductive health of cattle.

Among reproductive pathogens, *Brucella abortus*, *Leptospira interogans*, *Campylobacter fetus*, *Listeria monocytogenesis*, *Coxiella burnetii*, *Tritrichomonas foetus*, *Neospora caninum,* Bovine herpesvirus-1 (BoHV-1), Bovine viral diarrhea virus (BVDV), and Schmallenberg virus are the most important infectious pathogens that may impose a significant impact to the dairy industry and the national economy. Because of the high portion of subsistence dairy farming and no previously well recorded data in Ethiopia, there is little insight in infectious diseases of reproductive health of the dairy cattle in the country. In addition, there are only limited available evidences on the occurrence, prevalence, and distribution of some of the pathogens in Ethiopia. Therefore, understanding of the factors that influence the development, frequency and distribution of reproductive pathogens and their possible associations to the reproductive disorders is very crucial. In addition, assessing the genetic diversity of the pathogens is helpful to develop reliable diagnostic techniques, effective therapies, and appropriate control strategies. Moreover, some of the zoonotic pathogens have shown multiple resistance to antimicrobials used to treat infections in humans. Most of the zoonotic pathogens have been largely eradicated in developed countries, by robust control strategies and most importantly by the use of artificial insemination with semen from disease-free bulls.

Meanwhile, in Ethiopia lack of vaccines, predominant use of "sweeper" bull, combined with inadequate artificial insemination and poor veterinary services could be favoring the transmission dynamics of the pathogens. To plan appropriate intervention measures to prevent zoonotic reproductive disease outbreaks in cattle, and to avert subsequent economic losses and public health risks, it is imperative to understand cattle owners' knowledge and perception about reproductive zoonotic diseases, the prevalent on-farm practices that could predispose exposure to infections in cattle and humans. Reproductive diseases of dairy cattle can be prevented by vaccination and implementation of biosecurity measures. Vaccination against reproductive pathogens such as BoHV-1 and BVDV improved reproductive efficiency parameters in dairy herds. In Ethiopia, there is no vaccine available against these important pathogens of reproductive tract. Hence, early recognition of the diseases is very crucial for the implementation of management practices that decrease the risk of exposure of susceptible dairy cattle to emerging viral diseases. Because the efficacy of commercially available vaccines against BoHV-1 and BVDV have never been evaluated, it is not clear to what degree they may give protection in Ethiopian dairy cattle. Thus, more work is needed to get an answer to this question. Proper immunization using polyvalent vaccines containing the locally prevailing viral genotypes are recommended to

provide optimal protection against various field strains. However, the existence of multiple genotypes can pose a challenge to providing optimal vaccine coverage. Thus, detail research on identification of the circulating reproductive pathogens in Ethiopian dairy cattle is very crucial for the development of an efficient polyvalent vaccine in the country. The grand total budget estimated for this thematic research is 2,615,000.00 Ethiopian Birr.

Principal Investigator: Dr. Yitbarek Getachew

Members:

1. Dr. Balako Gumi
2. Dr. Tilaye Demissie
3. Dr. Mattios Lakew
4. Dr. Mollalegn Bitaw
5. Dr. Takele Abayneh
6. Dr. Abraham Ali

ETHIOPIAN INSTITUTE FOR ARCHITECTURE, BUILDING CONSTRUCTION & CITY PLANNING

Sustainable Development of the Construction Industry and Livelihood Improvement through Ethiopian Bamboo

Executive Summary

The construction industry in Ethiopia is growing exponentially, consuming the lion share of the country's capital budget. However, due to the status of Ethiopia as a developing country in sub-Saharan Africa, the current practice of engineering and construction is subpar in aspects related to design and construction, level of quality, use of material efficiency, and level of skilled manpower and educators.

One of the primary construction materials used other than steel and concrete is timber. Timber is used for truss structures, traditional housing frames, formworks and scaffolding to least a few, which is un-designed and constructed through traditional methods. The increasing cost for imported materials, lack of foreign exchange, need for improved materials and high deforestation is demanding the provision of a sustainable and alternative construction material.
One potential material is bamboo. Ethiopia has

over one million hectares of bamboo resource that corresponds to two thirds of all of Africa's current resources in the sector, with high local and international demand for industrial bamboo production. Bamboo has been described as the poor man's timber and has a wide range of uses, such as housing, furniture, screens, mats, agricultural poles, and agricultural tool handles. Yet, knowledge and use of this locally sourced material as an alternative construction material and possible use as a structural material is limited. Typically, bamboo has been used as an alternative construction material in Japan and East Asia. However, the practice of bamboo as alternative construction material in Ethiopia and sub-Sahara is very limited.

In this context, this project intends to develop a practical and fact-based approach in overcoming the underutilization of bamboo and establishing a holistic guideline that can be tailored into the construction industry's need for improved utilization on a continuous basis, through measurement and suitable benchmarks. Thus, this thematic research focuses on a comprehensive study in investigating the use of bamboo from growing and plantation to technology-based manufacturing or production of bamboo-based construction materials. This thematic research is divided into five sub-thematic research areas:

. i.) Sustainable bamboo resource management including nursery, quality control,

harvesting, and treatment;

. ii.) Structural grading and characterization of Ethiopian bamboo species based on basic material properties including physical and mechanical properties.

. iii.) Structural analysis and design of Ethiopian bamboo species.

. iv.) Lifecycle analysis of bamboo products used for construction purposes and;

. v.) Commercialization and standardization of bamboo products.

Limited studies exist to understand the lifecycle of bamboo, its use and benefits as an alternative and sustainable material and diversified product to the construction industry. In current practice, bamboo has a huge potential to replace timber, with high potential to influence the environment with respect to minimizing deforestation, increasing reforesting and reducing carbon footprint; socially with respect to enhancing productivity and improving safety; economically (low cost, providing income to community and available resource throughout the country). This thematic research focuses on analyzing the lifecycle of bamboo from different perspectives: environmental, social, economic and sustainability standpoint. It uses case studies of different products such as bamboo flooring, formwork, scaffolding, and panel products.

Hence, a research team that consists of expertise

and industry practitioners that have worked with research institutions, public agencies, consulting engineers and contractors who specialize in sustainable construction, structural engineering, environmental engineering and construction management have been assembled to develop bamboo-based construction products and technology that can be implemented by the construction industry. The research team consists of four higher educational institutions, Addis Ababa Institute of Technology (AAiT), Bahir Dar Institute of Technology (BiT), Addis Ababa Science & Technology University (AASTU) and Ethiopian Institute for Architecture, Building Construction and City Planning (EiABC). In addition, local vocational training colleges and international universities including Addis Ababa Tegbareid Polytechnic, Misrak Polytechnic, Tsingua University (China) and University of Zurich, (Switzerland) will partner with the research project for student exchange, technology transfer and conducting laboratory testing.

An integral part of the team will be various industry partners (Adal Industries P.L.C. and SA Bamboo Works) and agencies (Federal Micro and Small Manufacturing Industries Promotion Authority; International Network for Bamboo and Rattan, INBAR; Environment, Forest and Climate Change Commission (Federal Forestry research Center) and Ethiopian Standards Agency (ESA). These partners serve as testing

laboratories for investigating material property and industry advisory panel to assist the team in reviewing what the team produces, advising the research approach that is going to be implemented ranging from data acquisition, methodology and approaches and ensuring the team produces a product that is realistic and holistic that the construction industry can effectively adopt.

This thematic research is expected to be concluded in 4 years (48 months) with an estimated total budget of ETB 6,910,200.00.

Principal Investigator: Dr. Denamo Addissie

Members:

1. Dr. Asregedew Kassa
2. Dr. Edwin Zea
3. Dr. Esayas Gebreyohannes
4. Dr. Fu Jinhe
5. Dr. Kassahun Admassu
6. Dr. Kumulachew Yeshitela
7. Dr. Temesgen Wondimu
8. Dr. Yigardu Mengesha
9. Dr. Yang Yan
10. Alemayehu Darge
11. Haimanot Siefemichael
12. Leule Mebratie
13. Mitiku Damtie