



WORLD BANK GROUP

ACE CLIMATE SABC

Graduation Bulletin July 2021



Congratulations to Class of 2018

ACE CLIMATE SABC

Haramaya University, Ethiopia



Vision

ACE Climate SABC strives to be one of the leading Africa Centers of Excellence with international reputation by 2025.

Mission

The Mission of ACE Climate SABC is to produce competent graduates in diverse fields of study, undertake rigorous, problem-solving and cutting-edge research, disseminate knowledge and technologies, and provide demand-driven and transformative community services.

Motto "Venturing to a resilient future"

PhD Programs

- Ph.D. in Climate Smart Agriculture and Biodiversity Conservation with the following sub-specializations
 - Crop
 - Soil and Water
 - Livestock
 - Policy, Institutions, and Innovation
 - Biodiversity Management

MSc. Programs

- MSc Climate Smart Agriculture
- MSc in Biodiversity and Ecosystems Management

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ACE CLIMATE SABC
Graduation Bulletin
July 2021

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Editor's Note



Dear readers, this graduation bulletin is prepared in commemoration of 2021 graduates of ACE Climate SABC, scholarship project funded by the World Bank at Haramaya University. In this year of 2021, the Center has successfully graduated 14 students who have defended their Masters of Science Theses in Climate Smart Agriculture and Biodiversity Conservation.

The bulletin contains messages of the president of the University, Center leader, deputy Center leader, training and research head and thesis abstracts of the students. In addition, it contains project management and its challenges and prospects and project communication and the ways out. What is more interesting in the bulletin is selected students' case stories which are written by some of the students about their views on their overall study time and intercultural interactions between regional and national students. Last, but not least, almost all the graduates have expressed their feelings in their last words published in the bulletin.

This graduation bulletin is written in a clear, and easy to understand language. It is clearly organized and well designed using attractive photographs of graduates celebrating their graduation ceremony. I hope you will find it very catchy to read. Enjoy reading it!!



Congratulations!

About the ACE CLIMATE SABC

The Africa Center of Excellence for Climate Smart Agriculture and Biodiversity Conservation (ACE Climate SABC) at Haramaya University is a breakthrough to the continued growth and program enhancement centered on the task of tackling loss of agricultural productivity as a result of climate change and loss of biodiversity across Eastern and Southern Africa region. To achieve its visions and missions, it provides competitive based scholarship for young scholars from different countries in Eastern and Southern Africa.

Haramaya University serves as a hosting university for the ACE Climate SABC to advance and generate teaching and research outcomes in the fields of climate smart agriculture and biodiversity conservation. The Center is aimed at producing skilled human capital for Africa to tackle challenges posed by climate change through quality post-graduate training and research in collaboration with universities across Eastern and Southern Africa region and beyond. The Center was established with a competitive loan grant obtained from the World Bank. It became operational in October 2017.

Since its foundation, the Center has been running a PhD program in Climate Smart Agriculture and Biodiversity Conservation and two MSc programs in Climate Smart Agriculture, and Biodiversity and Ecosystems Management. To date, it has successfully graduated the first two cohorts of Masters students in 2020 and 2021. The center has enrolled a total of 44 PhD students and 85 MSc students out of which 35 are regional students constituting 7 Ph.D and 28 MSc students; whereas 94 are national students with 37 Ph.D. and 57 MSc.

The Center delivers quality education based on carefully designed curricula with both coursework and research projects facilitated and guided by faculty from Haramaya University and other universities in Eastern and Southern Africa region and other parts of the world. Most of the courses are delivered by qualified scholars coming from different universities in and out side of Ethiopia. In order to create a conducive environment for learning, the University committed two apartment buildings to accommodate regional students. Beyond these things, the Center created linkages with various stakeholders. Currently, ACE



About the ACE...Cont

Climate SABC has established collaborative partnership with Seven institutions and organizations. These are: African Conservation Tillage Network (ACT), Nairobi, Kenya; Natural Resource Institute of the University of Greenwich, UK; Purdue University, USA; Center of Excellence for Sustainable Agriculture and Agribusiness Management, Egerton University, Kenya; WISE-Future Center of Nelson Mandela Institute of Science and Technology (NM-AIST), Arusha, Tanzania; Aqua Soul (Mineral Water Factory), Dire Dawa, Ethiopia; and Harar Brewery, the Subsidiary of Heineken NPV, Harar, Ethiopia. These partnership engagements have supported the center a lot to achieve beyond its planned goals of training the targeted number of MSc and PhD students (i.e. 80 MSc and 30 PhD students). Moreover, the linkages

have served as a bridge to support close to Fifty staff exchanges for short courses and research. This year, the Center has installed state-of-the art video-conference facility for which the University has provided a matching fund of close to Four Million Birr. The video conference center would accommodate more than Forty participants in a room at a time. ACE Climate SABC has also facilitated the participation of the University in the Benchmarking initiative of the World Bank to rank universities into different categories of excellence. The ACE Climate SABC has coordinated and financed data collection, arrangement and submission for the Benchmarking. Six professionals have been participated from different fields of study for the task. At this time, the Center is looking for various grants to ensure its sustainability.

85

Total Number of MSc Students

28

Regional Stud.

57

National Stud.

44

Total Number of PhD Students

7

Regional Stud.

37

National Stud.



Message from the President

Jemal Yousuf, PhD

On behalf of the Office of the President of Haramaya University, I am pleased to congratulate all graduates of ACE Climate SABC of 2021. Looking back to all the times of late-night readings, sacrifice of sweet sleeps and enjoyment of all the students' destitution, it is a great achievement worth celebrating after all painstaking efforts you went through. Upon successful completion of your study, you have received not only the pride of your accomplishments but also the responsibility of taking that education as an instrument for making a difference wherever you can. As you are all aware, your education through your career up until today is supported directly or indirectly by your families and tax payers. You, therefore, owe your families and the citizens of this country for making your educational achievements to come to fruition. We hope to see people gratified by your extraordinary contributions to Africa's 2063 agenda at large and, in particular, to your nation's all-rounded growth through effective use of your newly acquired knowledge. As you are graduating today, you have proven

that you had already achieved profound successes. At this moment, I would like to let you know that this is not an end in itself but a beginning of self-realization to achieve greater successes and reap more rewards in your future career. Ahead of you is a bright future with more opportunities to grasp, and huge responsibilities to shoulder as well, because you have obtained an education that provided you knowledge and skills to face challenges in real world situations. Please, ensure that you continuously improve your knowledge and skills through life-long learning. I would also like to thank you in advance for choosing Haramaya University for your study. As you leave us from now on, after successful completion of your study, make sure to join the Haramaya University's alumni network. On behalf of the Office of the President of the University, I wish you brighter opportunities come your ways and you would achieve remarkable successes out of them. Once again, I would like to say Congratulations and Good Luck!!!

As you leave us from now on, after successful completion of your study, make sure to join the Haramaya University's alumni network... ” ”



Message from the Center Leader

Prof. Mengistu Urge

Dear Graduates,

First and for most, I would like to congratulate you all upon the successful accomplishment of a two-year academic journey at the ACE Climate SABC, Haramaya University, Ethiopia. I firmly believe that you have achieved a worth celebrating milestone which is a result of concerted efforts of your own, your professors, and Center's staff in particular and your families, colleagues and friends in general. You do not have to forget, however, that your graduation is the completion of a specific chapter but also the beginning of another one, perhaps the tougher for which you need to maintain the current momentum to prepare yourself for it. Myself, the current leader of the Center, and on behalf of Prof. Nigussie Dechassa who played a very significant role during the development of the project and led the center for couple of years tirelessly, I would like to say that it gives us a great honor to be part of the journey we have gone through over the past couple of years. Looking back to those years, it reminds me of the very foundation of our university which was established following the agreement entered between the governments of Ethi-

opia and the United States of America as a model of land grant University. The strong foundation resulted from the collaboration we have had so far helped the University to win a highly competitive grant from the World Bank to establish ACE Climate SABC as a regional hub which has already attracted students from eight different countries in the Eastern and Southern Africa region including Ethiopia. You, the graduates, finally completed your study from this regional hub after passing through all rigorous admission processes and scrupulous teaching and research activities for which you deserve huge congratulations. In this special occasion, I would also like to thank all who have a stake in the establishment and operation of the center. In particular I am grateful to the former center leader Prof. Nigussie Dechassa, and all of the other staff of the center for playing an outstanding leadership role which put the center in a good shape; affiliated faculty and visiting professors for sharing their distilled knowledge and phenomenal experience which were apparently worthwhile; the World Bank for financing the overall project; the Inter-University Council for East Africa (IUCEA) and Ministry of Science and Higher Education (MoSHE) of Ethiopia for their periodic supportive supervision. Lastly, yet importantly, I would also like to extend my appreciation to our university management for housing the center and hosting our esteemed students and for giving due attention and full support to the center. Once again, congratulations and stay connected as our productive and proactive alumni and I would also like to welcome you to rejoin the prestigious Haramaya University for your PhD studies, when the time comes.

Congratulations!!!!

ACE Climate SABC has become a regional hub and already attracted students from Eight different countries in the Eastern and Southern Africa region including Ethiopia. ” ”

Message from the Deputy Center Leader

Bobé Bedadi, PhD



Dear graduates,

On behalf of the Africa Center of Excellence for Climate Smart Agriculture and Biodiversity Conservation (ACE Climate SABC) of Haramaya University and myself, I would like to express my heartfelt congratulations to you upon the successful completion of your study. I would also like to offer my sincere congratulations and gratitude to your family members who have encouraged and supported you all. Your graduation marks the achievement of an important milestone in your academic growth after years of hard work and sleepless nights. It is normal to encounter many ups and downs during the study; what is important is that all those challenges that you encountered during your study made you stronger and contributed to the successful completion of your study. So, you must be proud of yourself. We are also very glad and proud of your achievements. Congratulations!

You were so lucky from the beginning for being competitively selected among the many applicants from different countries. As you have witnessed, one of the unique features of our Center is its regionality. The Center serves as a regional hub for Climate Smart Agriculture and Biodiversity Conservation studies for the Eastern and Southern Africa region. Our students are mainly drawn from Ethiopia, Kenya, Tanzania, Rwanda, Malawi, Uganda, Zambia, and Zimbabwe. So, in addition to the academics, the little African village formed at Haramaya due to the regionality of

the program must have given you a good platform to interact and learn from each other's cultures without the need to travel to each country. I hope you have had a memorable experience during the years of your study at ACE Climate SABC. No doubt, you will remember your frequent walk to Bate to purchase some vegetables.

As the Center is located in a rural setting, we understand that it was not easy for you to get ready access to big markets. The Center/University was, however, trying its level best to offer what is possible within its capacity to make your stay as comfortable and memorable as possible. Managing a regional program is a new experience to the University. So, it was like a learning experience for us. As a bridge to the nearby cities, the Center used to regularly arrange shuttle services to Harar and Dire Dawa free of charge to cater for your needs. Such a free service is not available even to the faculty members. All our efforts were to make you happy and comfortable because we always wanted to see your smiling faces. Nevertheless, we don't claim that there were no problems at all. Due to the very nature of the program and some external challenges we had, there might be cases where we might have not lived up to your expectations. For instance, the issue of sending money to your local account in your respective countries was not an easy task as it involves the willingness and efficiency of other parties like the National Bank of Ethiopia. Besides, someone from the Center has to travel to Addis and spend three to four days to process the same at the expense of the

much demanding office duties. Besides, COVID-19 pandemic has worsen the challenges. Despite the all these, we have been continuously learning from the challenges and trying to improve our services to you. We need your continued feedback in this regard to help us improve our services.

I hope you didn't have much challenges in the academic wing. In order to diversify the sources of knowledge and experience, the University tried to deliver courses by inviting high caliber resource persons from institutions of different countries regardless of its costs. Efforts were also made to organize field trips and internships so as to blend the theoretical knowledge you acquired in the class with practical skills. Short courses and seminars were also delivered by inviting scholars from renowned institutions to fill some gaps. In addition to the coursework, we believe that you have learned a lot from your thesis research in the process of identifying researchable problems, developing proposals, interacting with your supervisors, collecting and analyzing data, interpreting/writing and defending your thesis in front of examiners and audience. This is a breakthrough in your academic journey because you have revealed that you can independently conduct research with some guidance. So, you need to use this experience to solve societal problems by conducting problem solving research while at the same time upgrading your academic status to the next higher level. Society needs highly qualified personnel like you who is capable of making objective judgment and global networking. It is our

sincere hope that you have become highly skilled professionals, capable of utilizing the analytical abilities you obtained through your studies and research here at ACE Climate SABC to make contributions towards solving problems and creating new value not only in your country but also in Africa and at the global scale as well. Keep on growing academically while you are energetic. We expect you to publish your findings in reputable journals so that it can be accessed by the users (scientific community, policymakers and others) while at the same time improving your publication records. Some of the gaps that you identified during your Thesis research might have already triggered you for another follow-up research which may lead to your PhD study. So, keep on planning and acting for continued academic growth as learning is a lifelong process.

You have now become the family of Haramaya University. As alumni of ACE Climate SABC of Haramaya University, we expect you to maintain and strengthen your network with the University, your classmates and the faculty members for possible future collaborations. Moreover, we hope you will act as good ambassadors in promoting our Center and the University at Large. God willing, some of you may come back to Haramaya for your PhD study. Finally, I would like to thank all who contributed and are still contributing in various ways to the success of our students and the Center.

Congratulations once again and wish you all the best in your future career.

Take care and keep in touch!

In addition to academics, the little African village formed at Haramaya due to the regionality of the program is a good platform to interact and learn from each other's cultures without a need to travel to countries. ” ”



Dear Graduates,

It is my privilege to Congratulate each and every one of you on this remarkable achievement, your graduation. Graduation is a very personal achievement. It is the recognition of individual commitments and efforts. It is also about families and friends who helped you when you needed their supports, as well as various faculty members who inspired and encouraged you. Your graduation is even more meaningful as it is being done while we are facing a global pandemic that has taken many people's lives and making the teaching learning process difficult. This contagion has spread all over the world. It has caused many losses of lives and jobs. In far too many ways, you have seen how fragile our world can be. Accomplishing your academic work during this harsh time is especially worth celebrating.

Education has a power to liberate individuals, create a new generation and empower the nation. ACE Climate SABC at Haramaya University has been empowering and liberating hundreds of African young people with the hope that African Renaissance and the new pan-African spirit will prevail. Despite the unusual circumstances in which you completed your education, I want to highlight what an achievement

Message from Training & Research Head

Sintayehu Workeneh, PhD

it is. Life is full of ups and downs, joys and disappointments, hardships and windfalls. ACE Climate SABC prepared you for just this kind of moment even though you may not feel like you are succeeding in life and things are going the way you wanted them. Now, the whole HU and ACE Climate SABC are standing by you and wishing you a brighter future. We acknowledge and celebrate your hardwork during the years of study, and we want you to feel happy by knowing that experience and education will assist you in whatever challenges you may encounter. You succeeded in earning your degree and adapting to a global pandemic. Not bad! Walk down with pride this victorious path, celebrate this momentous achievement and continue to excel in the face of adversity. And if you find yourself feeling like you are alone or off that path, just ask for our help and we will be there for you. We are so proud of you and welcome you into the alumni family. You are not only our alumni but also our ambassadors. In this occasion, I would like to call upon you to be active alumni and ambassadors of the Center in particular and Haramaya University in general. Wherever you may stay and work, keep in touch and collaborate with us, and be the best ambassadors of the university. Last, but not least, I would like to thank your advisors, academic and administrative staff of the University who have shown full commitment for your successful accomplishments. I wish you all the best, congratulations once again!

Sintayehu Workeneh (PhD)

Training and Research Head, ACE Climate SABC

Education has a power to liberate individuals, create a new generation and empower the nation. ””

**THESIS
ABSTRACTS**

Effect of Combined Application of Vermicompost and Inorganic NPS Fertilizers on Yield Related Traits, Yield and Shelf Life of Shallot [*Allium cepa* Var. *Ascalonicum* Backer] at Haramaya, eastern Ethiopia

By Aberu Abebe, Ethiopian
Advisor: Dr. Wassu Mohammed
Co-Prof Tamado Tana (PhD)

This research was conducted to assess the effects of combined application of vermicompost (VC) and inorganic NPS fertilizer on bulb yield, yield related traits, shelf life of shallot, soil physical and chemical properties for sustainable nutrient management without harming the environment. The field experiment consisted of four rates of NPS (0, 50, 100 and 150 kg NPS ha⁻¹) and five VC rates (0, 2.5, 5, 7.5 and 10 t VC ha⁻¹) laid out in a randomized complete block design with three replications carried out in 2018/2019. Results of analysis of variances revealed that the rates of NPS and VC and their interaction significantly influenced all bulb yields and yield related traits of shallot except all factors on neck thickness of bulb(cm), interaction of NPS and VC on days to maturity and bulb length(cm) as well as NPS fertilizer on bulb length had nonsignificant effect. The two fertilizers and their interaction had significant effect on all selected physical and chemical properties of soil after harvesting of shallot except pH of the soil. The NPS and VC and the interaction of the two factors also significantly influenced bulb weight loss starting 30 to 90 days storage, rotten bulb and sprouting bulb of shallot except bulb weight loss at 15 days of storage and NPS x VC interaction on sprouting of bulb at 60, 75- and 90-days storage after harvest. Analysis of variances revealed that the highest plant height (72.1cm), leaf length (64.65cm), leaf number per plant (16.59), marketable bulb yield (70.49) and total bulb yield (72.92 t ha⁻¹) were observed from the interaction of 100 kg NPS ha⁻¹ with 5 t VC ha⁻¹. The widest bulb diameter (8.067cm) and highest mean bulb weight (135.2 g) were registered from the interaction of 100 kg NPS ha⁻¹ and 10 t VC ha⁻¹ and highest bulb dry matter (13.430%) were produced from combined application of 100kg NPS ha⁻¹ with 7.5 t VC ha⁻¹. The interaction uses of 100-150 kg NPS ha⁻¹ with 5-10 t VC ha⁻¹ increased significantly than control treatment for organic carbon, total nitrogen, available K, available P, Cation exchange capacity, and water holding capacity of the soil. The highest physiological weight loss (31.89%) was observed at the combined application of 150 kg NPS fertilizer ha⁻¹ and 10-ton VC ha⁻¹ during 90th day storage period. While lowest weight loss was recorded from the combined application of 100 kg NPS ha⁻¹ and 5 t VC ha⁻¹. The highest percentage bulb sprouting was recorded for plants fertilized with 150 kg NPS ha⁻¹ and 100 kg NPS ha⁻¹ at 60th day after storage. The highest percent of rotten bulbs were observed under combined application of 150 kg NPS ha⁻¹ and 10 t VC ha⁻¹ 60th day from storage period. In contrast, the interaction of 100 kg NPS ha⁻¹ with 5 t VC ha⁻¹ resulted in lowest bulb rotting next to unfertilized plots at 60th day storage period. The highest marginal rate of return (MRR%) of 25632% was estimated for plots that received 100 kg ha⁻¹ NPS fertilizer, but the highest adjusted marketable bulb yield of 63.441 t ha⁻¹ with the highest net benefit and benefit to cost ratio of 1,469,548 Birr ha⁻¹ and 4.79, Birr ha⁻¹ respectively, were estimated for plots that supplied 100 kg ha⁻¹ NPS fertilizer in combination of 5 t ha⁻¹ vermicompost. The MRR (%) of 2186.48% was estimated for this treatment, thus the tentative recommendation was made in favor of the application of 100 kg ha⁻¹ NPS fertilizer in combination of 5 t ha⁻¹ vermicompost for shallot production at Haramaya.

Keywords: Inorganic fertilizer, Organic fertilizer, Marginal rate of return, and Soil fertility.

THESIS ABSTRACTS

Effects of Furrow Irrigation Methods and Intervals on Tuber Yield and Quality of Potato (*Solanum tuberosum* L.) Genotypes at Haramaya, Eastern Ethiopia

By: Bayush Legesse, Ethiopian
Advisor: Dr. Denedena Galmessa
Co-Dr. Yibekal Alemayehu

Potato is an important cash and food security crop in mid and highlands areas of eastern Ethiopia. However, the yield of the crop is constrained by many factors including improper application of irrigation amount and intervals. The field experiment was conducted at Haramaya University (Raare) research station during 2020 cropping season to assess the effects of furrow irrigation methods and intervals on tuber yield and quality of potato genotypes and to estimate water productivity and optimum irrigation amount for potato production. The treatments consisted of two potato genotypes (Bubu and CIP-392781.1), two furrow irrigation methods (fixed and alternate), and three irrigation intervals (6, 8 and 10) arranged factorially in a randomized complete block design with three replications. Phenological, growth, tuber yield and yield related parameters, tuber quality and water productivity were collected. The result revealed that the main or interaction effects of genotype, furrow irrigation methods and intervals significantly ($P < 0.05$) affected most of the measured traits. Both varieties had resulted in higher marketable tuber number per hill under alternate furrow than fixed irrigation method and at higher rates of irrigation interval. The highest average tuber weight (158.03 g) was registered from genotype CIP-392781.1 with fixed furrow irrigation method at six days irrigation interval. Bubu under fixed and alternate furrow irrigation methods and CIP-392781.1 under fixed furrow irrigation method had resulted in significantly higher marketable tuber yield in the range of 33.85 to 35.78 t ha⁻¹. On the other hand, higher tuber dry matter content (21.97%) and tuber specific gravity (1.10 g cm⁻³) were observed under increased rates of irrigation interval for genotype CIP-392781.1. Alternate furrow irrigation method at eight days interval had resulted in the highest water productivity (13.20 kg/m³) for genotype Bubu while it is the lowest (8.70 kg/m³) for genotype CIP-392781.1 at six irrigation intervals with the same irrigation method. Moreover, 17.6% of irrigation water saved under alternate furrow irrigation methods at eight days interval could irrigate additional area of 0.25 ha to compensate reduced tuber yield as a result of deficit irrigation. For instance, applying alternate furrow irrigation method increased additional tuber yield of 8.77 ton that can earn additional returns to potato producers as compared to fixed furrow irrigation method. This suggests that for maximizing tuber yield under non-water stress scenario, irrigation water could be used in a fixed furrow irrigation method. However, under limited irrigation water scenario and high cost of irrigation water, irrigation could be applied in alternate furrow irrigation method at six days interval to minimize water loss, maximize water productivity, and improve tuber yield in the study area and similar agro-ecology.

Keywords: Alternate irrigation; Drought tolerance; Fixed irrigation; Water productivity

THESIS
ABSTRACTS

An Assessment of the Effectiveness of Ecosystem-based Adaptation for Local Communities Living around Lake Kibare Riparian zone, Rwanda

By Johvanie Mukankubana

Major Advisor: Dr. Ketema Bekele (PhD), Haramaya University

Co-Advisor: Prof. Beth Kaplin, University of Rwanda

Local communities' adaptation to climate change requires measures that simultaneously reduce poverty, protect or restore biodiversity and ecosystem services, and remove atmospheric greenhouse gases. Ecosystem-based Adaptation (EbA) involves measures for climate change mitigation and adaptation that aim to strengthen the resilience of local communities vulnerable to climate change effects. It combines measures to achieve these multiple outcomes and is particularly relevant to developing nations that safeguard most of the planetary biodiversity and healthy ecosystems. This study aims to evaluate the effectiveness of the implemented Ecosystem-based Adaptation intervention measure in Lake Kibare riparian zone in Rwanda. Lake Kibare was identified as a site for EbA investments because it was seen to be vulnerable to climate change impacts. Primary data were collected using both GPS and structured questionnaire while secondary data were collected from government reports, conference proceedings, and primary literature. The results showed that the bamboo planted in the Lake Kibare riparian zone as an EbA measure is growing and thriving with new shoots (48% of the bamboo). It provides many ecosystem services to the local communities including landscape beauty and restoration (85.54%), maintenance of biodiversity (77%), and regulation of climate (69%). Bamboo provides socio-ecological resilience for local communities surrounding the study area. The implemented EbA intervention approach was reported to be very effective (61.45%) by community members interviewed. However, there are some negative effects associated with this intervention (60.24%) which are mainly food insecurity and famine for local communities who used the Lake Kibare riparian zone for agricultural practices, but are now no longer allowed to use it. Besides bamboo plantation, other reported EbA intervention measures were mentioned by the community members that were implemented prior to the EbA project, including installation of rainwater collection units at individual households and underground water tanks which have helped local communities. Community members also mentioned constructed dams and flood canals. However, there is still a need to raise awareness about the benefits obtained from the EbA intervention measures to help local communities to be integrated into their implementation

Key words: Climate change, Ecosystem-based Adaptation, effectiveness, local communities

THESIS
ABSTRACTS

Genetic Diversity Among Bread Wheat (*Triticum aestivum* L.) Genotypes for Drought Stress Using Agro-Morphological Traits and Phenotypic Markers

By: Kassahun Tadesse
Major Advisor: Dr. Bulti Tesso
Co-Dr. Tesfaye Letta

Assessment of genetic diversity and variability in crop species is one of the major activities of plant breeding which helps to design breeding methods and/or selection of genotypes for further evaluation to meet the diversified goals including breeding for drought stress conditions. Field experiment was conducted to assess the genetic diversity among bread wheat genotypes, to determine the association among traits, and estimate the direct and indirect effects of traits on grain yield. A total of 33 bread wheat genotypes and 3 released varieties were evaluated in 6 x 6 Simple Lattice Design at Goro and Ginnir research station of Sinana Agricultural Research center in 2019 cropping season. The analysis of variance for each location and over two locations revealed highly significant differences among genotypes for all studied traits except for stand count and hectolitre weight. Location and interaction of genotype x location also had a significant effect on the performance of genotypes for most of the traits. The variation of the genotypes for grain yield was ranging from 2.8 to 4.4 t ha⁻¹. Estimated phenotypic coefficient of variations (PCV) and genotypic coefficient of variations (GCV) coefficient of variations were ranged from 0.00 to 26.98% and 6.96 to 24.98%, respectively. Heritability in a broad sense and genetic advance as percent of the mean (GAM) were ranged from 43.91 to 85.76 and 3.3 to 47.6%, respectively. The estimates of GCV and PCV, H², and GAM were high for biomass yield, spike length and primary root length over two locations. Grain yield had shown positive and highly significant correlation with spike length, number of spikelets per spike, number of kernels per spike, thousand seed weight, harvest index, and primary root length at both genotypic and phenotypic levels, however, grain yield had shown negative and highly significant correlation with days to heading and maturity at both genotypic and phenotypic levels at both locations. Spike length, number of spikelets per spike and harvest index had shown a high and positive direct effect on grain yield at both genotypic and phenotypic levels which suggested that the direct selection of genotypes for these traits will be effective to identify genotypes for high grain yield. The first three Principal Component analysis (PCA1 to PCA3) with Eigenvalues >1 accounted for the total variation of 82.25%. The genetic distances among the 36 bread wheat genotypes estimated using Euclidean distance showed a value ranging from 1.60 to 13.71, with the values of mean, standard deviation, and coefficient of variation of 5.24, 1.85, and 35.34%, respectively. The genotypes were grouped into four distinct clusters of which Clusters II, III, I, and IV consisted of 41.66%, 27.8%, 22.2%, and 8.3% genotypes, respectively. The wheat genotypes understudy showed variations for morphological and agronomical drought-related traits such as plant waxiness, early ground cover, leaf morphology, and stay greenness. Out of 36 tested genotypes for the qualitative traits with 'good' and 'very good' scales accounted 41.7% for waxiness, 33.4% for early ground cover, and 33.3% for stay greenness traits. The largest proportion of bread wheat genotypes showed leaf curling morphology which is one of the morphological traits for drought stress wheat characterization. Generally, the result of this research showed the presence of high diversity among bread wheat genotypes for yield and drought tolerance morphological markers that could be potentially be exploited in the future wheat breeding programs for drought-stress areas.

Keywords: Drought, Clustering, Direct effect, Early ground cover, Stay greenness, Waxiness.

THESIS
ABSTRACTS

Determinants of Smallholder Farmers' Adoption of Climate Smart Agricultural Practices in Laikipia Central Sub-County, Kenya

By: Mahinda Betty Wanjiku
Advisor: Prof. Fikadu Beyene
Co-advisor: Oscar Ingasia

Climate variability and change is increasingly threatening livelihoods and food security and in turn, the attainment of national development goals in Kenya. The declining productivity of agricultural production systems calls for a transformational change in farming practices to ensure sustainable and resilient agriculture. This study assessed smallholder farmers' perception of climate variability and change, climate smart agricultural practices used by farmers to adapt to climate change and analyzed factors influencing adoption of climate smart practices in response to climate variability and change. Primary data were collected from 204 smallholder farmers within Laikipia Central sub-county through interview schedule and checklists for key informant interviews while secondary data were obtained from Center of Training and Integrated Research in Arid and Semi-Arid Land Development. Descriptive statistics and econometric model were used to analyze the data. The study showed that 100% of the respondents had noticed changes in climate but with varying perceptions of the extent and direction of change of rainfall and temperature parameters. The farmers had adopted a wide range of climate smart agricultural practices and those evaluated for this study included crop diversification, manure management, change of crops, change of planting dates, high yielding varieties, on-farm water conservation, fodder production and crop rotation. Results from the Multivariate Probit Model indicated that membership to an agricultural group, farm assets, size of farm, access to weather and climate information, access to extension, access to credit, market distance and number of livestock owned influenced adoption of climate smart agricultural practices positively. The study recommends building the financial capacity of the farmers, enhancing timely delivery of quality weather and climate information, looking into ways of conflict resolution, sensitizing farmers on climate adaptation to change their concept and encouraging formation of farmer groups and producer organizations.

Key words: Climate smart agriculture, Practices, Adoption, Climate variability and change, Determinants, Adaptation.

**THESIS
ABSTRACTS**

Assessment of Smallholder Farmers' Adoption of Climate Smart Agricultural Practices: The case of Bugesera District, Rwanda

By: Marrie Grace Ntezimana, Rwandan

Advisor: Prof. Fikadu Beyene

Co-Dr. Bazimenyera Jean De Dieu

Rwanda, like other developing countries, has experienced climate variability and change. This declined agricultural productivities results into decreased national and household food security. To adapt to the changing climate, farmers need a transformation in their farming practices and adopt various practices that sustainably increase agricultural productivity as well as their resilience. This study assessed smallholder farmers' perception to climate variability and change, climate smart agricultural practices adopted and determinants influencing the adoption among farmers by focusing on smallholder farmers in Bugesera district, Rwanda. Primary data were collected from 204 randomly selected households survey, focus group discussion and key informant interview. Secondary data obtained from three stations under Rwanda Meteorological Agency (RMA) to describe the trends in climatic. To address the research objectives, descriptive statistics and econometrics model were used to analyze the data. The results revealed that the majority (85.3%) of farmers perceived a change in climate variability and change where 55.9% of the respondents noticed decreased rainfall and 47% noticed an increased temperature. The results confirm that the likelihood of households to adopt change in planting time, crop rotation, Agroforestry, on-farm water conservation, and use of improved crop varieties were 80.6%, 68.9%, 79.3%, 58.6% and 78.2% respectively. The results from Multivariate Probit model revealed that farm size, farming experience, access to credit, access to agricultural extension services, access to weather and climate information, climate change perception, social groups membership are the major determinants of various climate smart agricultural practices. To enhance the level of climate smart agricultural practices adoption, further interventions should focus on weather and climate information dissemination to the smallholder farmers to increase their knowledge on climate change and the climate smart agricultural practices established by the government can be managed by the smallholder farmers through their different social groups.

Key Words: Climate smart agriculture, Climate variability and change, Adaptation, Determinants

THESIS ABSTRACTS

Distribution of Sweet Potato Viruses and Vectors in Homabay County, and Under Climate Change Scenarios in Kenya

By: Quinter Akinyi Oginga
Advisor: Prof. Chemedo Fininsa
Co-Dr. Simon Onywere

Sustainable agricultural productivity and food security are critical concerns in the face of climate change. Sweetpotato (*Ipomoea batatas*) is among climate smart crops that can strengthen farming resilience and enhance food and nutrition security in Sub-Saharan Africa. However, farmers have not been able to achieve optimum productivity partly due to diseases caused by sweet potato viruses. This study sought to identify experiences and practices of sweet potato growers; assess prevalence of sweet potato viruses (i.e Sweet potato chlorotic stunt virus (SPCSV), Sweetpotato feathery mottle virus (SPFMV) and vectors; and model their future distribution under climate change scenarios of RCPs 4.5 and 8.5. Survey was conducted and virus testing done using RT-PCR. A total of 294 presence data of sweet potato viruses (SPCSV, SPFMV and begomovirus) and 65 presence data of vectors (whitefly and aphid) collected from field surveys and the Kenya Agricultural and Livestock Research Organization (KALRO) database were used as dependent variables. Bioclimatic data retrieved from AfriClim and soil data from ISRIC database were used to model the spread of sweet potato vectors and viruses using the MaxEnt model. Occurrence of virus disease and vectors was 51% and 31.6% respectively and the models' most significant variables were moisture (moisture index moist quarter) and temperature (number of dry months and length of longest dry season). The results showed that on one hand, geographical extent of areas at risk of sweet potato virus disease will increase for Kenya under future climate change scenarios from a current 36,736.09 km² to about 63,179.76 km² by 2085 under RCP 8.5. On the other hand, virus disease risk incidence will decrease for Homabay County in future climate scenarios from a current 2,804.92 km² to 2,625.05 by 2085 under RCP 4.5. Increase in temperature and moisture variables will enhance niche suitability for sweet potato viruses and vectors. Therefore, the situation calls for climate smart practices such as better crop timing, better cultivar choice and management, integrated pest management and sustainable cropping systems to enhance sustainable production of sweet potato crop.

Key words: Climate change, Climate smart agriculture, Sweet potato viruses, vectors, MaxEnt

THESIS ABSTRACTS

Integrated Management of Fall Armyworm *Spodoptera frugiperda* (J.E. Smith) in Maize (*Zea mays* L.) at University of Zambia, Field Research Station

By: Thelma Mwila, Zambian,
Advisor: Dr. Mulatu Wakgari
Co-Dr. Kalaluka Munyinda

The fall armyworm (FAW) (*Spodoptera frugiperda*) is a devastating pest of maize which has recently invaded the African continent. Since its first reports in Africa in 2016, it has spread rapidly in Zambia and it is causing extensive damage to maize and other cereal crops. The efficacy of the integration of botanical pesticides with entomopathogenic fungi and synthetic pesticide, on FAW were tested under field conditions. The experiment was laid out in a randomized complete block design (RCBD) with 11 treatments replicated 4 times. The treatments were 1 Ampligo 150 SC, 2 Garlic oil, 3 Neem oil, 4 *Beauveria bassiana*, 5 Garlic oil + Neem oil, 6 Ampligo 150 SC + Garlic oil, 7 Ampligo 150 SC + Neem oil, 8 Ampligo 150 SC + Garlic oil + Neem Oil, 9 *B. bassiana* + Garlic oil + Neem oil, 10 *B. bassiana* + Garlic oil + Neem Oil + Ampligo 150 SC and 11 the untreated control. Results on FAW infestation showed treatment with Ampligo150 SC and with the rotation of Ampligo150 SC with garlic oil had the lowest percent leaf damage. Ampligo150 SC and the rotation of Ampligo150 SC with garlic oil, as well as garlic oil alone, showed superior results in reducing the mean larvae count. In terms of grain yield, analysis of variance showed a significant difference ($p < 0.001$) among treatments. The rotation treatment of Ampligo150 SC with Garlic oil gave the highest mean grain yield of 5.05 tons/ha followed by the sole treatment of Ampligo150 SC (5.02 tons/ha). The sole garlic oil treatment gave grain yields of 4.52 tons/ha. It was concluded that the effective botanical pesticide, garlic oil, the chemical pesticide, Ampligo 150 SC and the rotation treatment of Ampligo 150 SC with garlic oil can be used in management of FAW. Therefore, farmers can use chemical pesticides in rotation with botanicals pesticides to obtain maize yields that are comparable to using chemical pesticides alone, while reducing the risk of pesticide resistance development in FAW.

Key words: FAW, IPM, *Beauveria bassiana*, Garlic Oil, Neem Oil, Ampligo 150SC

THESIS ABSTRACTS

Woody Species Diversity and Carbon Stock Variation along Altitudinal Gradients at Muhabura Volcano, Northern Rwanda

By: Uwimbabazi Agnes

Advisor: Dr. Sintayehu Workeneh Dejene

Co- Prof. Jean Nduwamungu

This study was conducted at Muhabura Volcano, in Volcanoes National Park, Northern Rwanda, to determine woody species diversity and carbon stock potential of woody species along altitudinal gradients. Reconnaissance survey was conducted before the actual field work where stratification by elevation segments was used since the area under the study present an altitudinal variation. Then the study area was stratified into three strata based on physical appearance of vegetation and elevation gradients: stratum 1 (low altitude which lies between 2502-2882 m a.s.l), stratum 2 (middle altitude which lies between 2883-3109 m a.s.l) and stratum 3 (upper altitude which lies between 3110-4127 m a.s.l). A total of 60 plots of 20m x 20m with 4 transect lines were used to collect information on woody species, litter and soil in three altitudinal gradients. A total of 21 woody species that belonged to 16 families were identified at Muhabura volcano. The overall species richness, Shannon wiener, Simpson, evenness and similarity indices values of the entire study area were 21, 2.46, 0.46, 0.65 and 0.38 respectively. The results of the study showed that the woody species diversity at low altitude was considerably more with even distribution while that of middle altitude was less diverse and dominated by few species. The most dominant species in the low altitude is *Hagenia abyssinica* (23%), the middle altitude presents *Erica arborea* (77%). There was no woody species with DBH greater or equal to 5 cm in the high altitude. The estimated total carbon stock in low, middle and high altitude were 162.0299 ± 9.0944 t ha⁻¹ and 142.7676 ± 0.3984 t ha⁻¹ and 132.923 ± 18.8068 tons ha⁻¹, respectively, which showed a significant difference ($P < 0.05$). Similarly, soil organic carbon had a significance different across depths (0-30cm, 30-60cm) in altitudinal gradients ($P < 0.05$). The largest carbon pool in all the three altitudinal gradients was soil organic carbon pool sinking the highest carbon amount of 397.551 ± 77.307 tons C tons ha⁻¹. The results showed that Muhabura Volcano can be important for carbon stocks. Therefore, effective conservation of this mountain has a considerable contribution to climate change mitigation and biodiversity conservation. Thus, there is need to continue enforced protection against anthropogenic disturbances including fires and invasive exotic species at Muhabura Volcano, that could interfere with further carbon sinking, storage and biodiversity conservation.

Key words: Muhabura volcano, woody species structure, carbon sequestration, climate change

THESIS ABSTRACTS

Socio-Ecological Impacts of Water Hyacinth (*Eichhornia crassipes*) Invasions on Akanyaru Wetland, Rwanda

By: Josine Tuyishime
Advisor: Sintayehu Workeneh (PhD),
Co- Prof. Elias Bizuru

Water hyacinth has been reported to invade African freshwater bodies massively during 1950's due to eutrophication. In Rwanda, the weed has been reported to invade Akanyaru river in 1987. Presently, it has been found almost all over the country, which resulted in a chronic environmental, social and economic problem in the country. Therefore, the aim of this study was to explore the socio-ecological impacts of Water Hyacinth (*Eichhornia crassipes*) infestation on Akanyaru wetland in Rwanda. The data was obtained through stratified sampling method where the sampled area was stratified into three strata according to the level of Water Hyacinth invasion (High invasion (Musenyi); Medium invasion (Ntarama) and No invasion (Nyarugenge). Moreover, household survey was conducted to explore the socio-economic impact of the species. The results have shown that Water hyacinth affect water quality of Akanyaru river as the highest TDS, Turbidity, Temperature, EC and BOD were recorded at highly invaded area and the highest DO, Sulphates, phosphates and nitrates recorded at the area with no invasion. About 16.33% of the respondents have responded that they use a lot of time for fishing, 13.78 % responded that Breaking fishnet is the problem, 2.55 % responded that they do face a problem of disappearance of some fish species, 30.10 % responded hindering fish catchability and 32.65% the increase in fish price. About 31.12% of the respondents have responded that water hyacinth affect transport by causing the increase in time to reach the destination, while 28.06 % said that it reduced income inquired from transport industry; 12.24% of the respondents responded that it causes flooding in their farms, while 33.67 % responded that it causes water level reduction which affect water needed for irrigation purposes. The weed does also affect the macrophyte community composition and diversity negatively as during the study a huge number of macrophyte species were recorded at the area with no invasion, and in some cases the weed has been noticed that it changed the community to nearly a monotypic community. Understanding the impacts of the species will help to improve management programs and policies to address its socio-economic and ecological menace. It also helps government and non-government organizations to assist communities whose livelihood activities have been affected by the invasion of this weed.

Keywords: Water hyacinth, Water quality, Macrophyte, Akanyaru, Wetland, Socio-economic problem

**THESIS
ABSTRACTS**

Floristic Composition and Economic Value of Dengego Valleys and Mountain Complex Ecosystem, Eastern Ethiopia

By: Kidist Teshome Eticha
Advisor: Dr. Anteneh Belayneh
Co- Dr. Ketema Bekele

Dengego valleys' and mountains' complex landscape ecosystem has been reported to harbor rich floristic diversity with endemism; but so far, remained unexplored systematically. In addition, the economic values of this complex ecosystem to the local community need to be evaluated. A total of 58 quadrats each 20m x 20m for trees, 5m x 5m for shrubs and woody climbers, and 1m x 1m for herbs and grasses were used to collect floristic data. Vegetation parameters such as height and diameter at breast height of woody species and number of plant species were recorded. A total of 384 households were identified for questionnaire using random sampling method from three Kebele's and important attributes were identified by focus group discussion (FGD) before the questionnaire for economic valuation. The willingness to pay (WTP) was estimated by choice experiment modelling with mixed logit (random parameter logit) model which is 38.51 and -3764 birr for biodiversity and soil erosion respectively. Shannon Weiner Diversity Index, richness, and evenness were used to analyze vegetation data. A total of 121 plant species belonging to 91 genera, and 48 families were identified, of which 10 species (8.3%) were endemic. Poaceae and Fabaceae were represented by the highest number of species (11 species=9.09%) each. The overall species richness, Shannon-Wiener Diversity Index (H') and evenness values for the entire study area were 121, 3.12 and 0.38, respectively. The total average basal area of woody species in the study area was 2.10m²/ha. Three vegetation community types were identified dominated by *Acacia tortilis*-*Rhus natalensis*, *Ficus vasta*-*Acacia brevispica* and *Psychotria orophila*-*Canthium pseudosetiflorum*. Biodiversity and reduction of soil erosion were the two prioritized attributes for economic valuation. Biodiversity attribute was positive and significant at 1%. However, the attribute of reducing soil erosion were negative and significant at 1%. Payment had a negative coefficient and significant at 1% which indicates *Ceteris paribus*, the result is consistent with consumer demand theory. Generally, it possesses many ecologically and economically important plant species, which can be considered as one of the semi-arid natural vegetation genetic resources conservation Centre in Eastern Ethiopia. Therefore, the maintenance of floristic diversity works should be emphasized to promote sustainable use of the natural vegetation and ecosystem values within the ongoing conservation practices.

Keywords: Basal area, endemic species, mixed logit, soil erosion, species diversity

THESIS
ABSTRACTS

Willingness to Pay for Mangrove Conservation in the Context of Climate Change in Mombasa County, Kenya

BY: Virginia Mumbua, Kenyan

Advisor: Dr. Ketema Bekele

Co-Dr. James G. Kairo

Mangroves in Kenya have been highly degraded due to anthropogenic and natural stressors. However, restoration is expected to help deal with climate change and support livelihood development through provision of goods and services. This study was carried out to analyze households' willingness to pay (WTP) for mangrove conservation in the context of climate change in Tudor Creek, Mombasa County. Contingent valuation method (CVM) was employed to elicit information on WTP from a randomly sampled 414 respondents in 6 villages adjacent to Tudor Creek. Semi-structured questionnaires, key informant interviews and focused group discussions were used to collect primary data. The obtained data were subjected into descriptive statistics, correlation and regression analyses using Statistical Package for Social Sciences (SPSS 24) and R software. Results showed that majority of the respondents (93.7%) were aware of mangrove goods and services. Moreover, 68.2% of the respondents were willing to pay between KSH. 50 to 2000 per month for mangrove conservation activities. The mean WTP was estimated to be KSH.14,052 (US\$ 140.52) per household per year while the aggregate value of the 1641ha of mangroves in Tudor creek was estimated at 6906.72 US\$/ha/year. Regression results revealed that age, participation in conservation activities and climate change awareness were significant factors affecting respondent's WTP for mangrove conservation. The results suggest that the mangrove forest is of high value and thus need for concerted efforts for conservation and inclusion in national and county development planning. In addition, local awareness of mangrove importance should be publicly enhanced in the context of climate change and urbanization.

Key words: Mangroves, Conservation, Willingness to pay, Households, Climate change

THESIS
ABSTRACTS

Modeling Spatiotemporal Distribution of *Prosopis juliflora* under Climate Change Scenarios in Marigat Sub-County, Kenya

By: Viola Kishoin
Advisor: Dr. Nega Tassie
Co-Prof. George Ogendi

Prosopis juliflora is an invasive species that has caused adverse ecological, social and economic impacts in Kenya. Climate change is anticipated to aggravate the spread and invasion of this species. This is now raising concerns because further expansion of this species will worsen its negative impacts on the livelihoods of the adjacent communities, and on the ecological integrity of the invaded areas. There is limited understanding and knowledge on the influence of climate change on the distribution of *P. juliflora*. Therefore, the aim of this study was to model the current and future distribution of *P. juliflora* under different climate change scenarios in Marigat sub-county; to better influence appropriate decision-making processes on the management of this invasive species. In this study, MaxEnt model was used to predict the current and future distribution of *P. juliflora* under different climate change scenarios. The results indicated that mean annual temperature, mean annual rainfall, elevation and moisture index moist quarter were the main factors that determined the distribution of this species. Further, climate change is expected to increase the potentially suitable areas for this species across all the future climate change scenarios. The greatest increase is experienced in 2055 under RCP 8.5 and 2085 under RCP 8.5 with an average range increase of 34.7% and 24.3% respectively. With the current cover, *P. juliflora* has already caused significant negative impacts in this study area. Further expansion would worsen the problem leading to more decline in the community livelihoods and damage to the environment. Therefore, urgent, appropriate, effective and efficient *P. juliflora* management measures need to be urgently taken to counter its spread. The stakeholders both at the county and national government should take coordinated actions and put in place integrated approaches to combat further expansion, eradicate or minimize the negative impacts of the species.

Keywords: Climate change, Marigat, MaxEnt, *Prosopis juliflora*, Species distribution

THESIS ABSTRACTS

Plant Species Diversity, Structure, and Carbon Stock Status of Senkelle Swayne's Hartebeest Sanctuary, Southeastern Ethiopia

By: Zinash Fitala, Ethiopian

Advisor: Dr. Abebe Aschalew

Co-Dr. Sintayehu Werkeneh

Forests have the potential to address many environmental and sustainability challenges. Yet in Ethiopia, Sanctuary forest characterization and its potential to contribute to human wellbeing are not well studied and assessed. This study was carried out at Senkelle Swayne's Hartebeest Sanctuary, Ethiopia to assess plant species diversity, determine vegetation structure of woody species and estimate carbon stock in above and belowground woody biomass, litter, herbs, grasses (LHGs) and soil organic carbon. A stratified systematic sampling method with a total of 30 sampling plots, each with the size of 20 x 20 m² for trees and shrub and five sub plots of size 1 x 1 m² were established for trees and shrubs, Litter, herbs, grasses (LHGs) and soil data collection. Woody plant species with diameter at breast height (DBH) >2.5 cm were measured for structural analysis and carbon stock estimation. Aboveground biomass of woody species was computed by using Allometric equation. A total of 102 plant species that belong to 82 genera and 44 families were identified, out of which 26.47%, 18.63%, 33.33%, 17.65% and 3.92% were trees, shrubs, herbs, grasses and climbers, respectively. From the total 102 species, 46 woody species (27 trees and 19 shrubs) that belong to 35 genera in 29 families were recorded for structural analysis and carbon stock estimation. The value of Shannon Wiener Diversity Index and Evenness for the whole vegetation is 3.95 and 0.86, respectively. The result indicated that the study area is rich in plant diversity but low in evenness due to high level of disturbance that resulted from human activities and livestock grazing. The result of vegetation structural analysis DBH and height class distribution showed an inverted J shape which reflect the highest density in the lower DBH and height class followed by decrease in the middle classes and finally terminate by slight increase in higher class. This is due to the removal of larger species for firewood and construction. The total basal area and density of woody species was 23.43 m²ha⁻¹ and 843.32 ind ha⁻¹, respectively. The result of species RF and Importance Value Index showed that *A. abyssinica*, *A. albida*, *A. seyal*, *A. clavigera*, *C. macrostachyus*, *A. lahai* and *M. arbutifolia* were the dominant and ecologically important species. The mean total carbon stock and CO₂ equivalents of SSHS were 188.47 and 690.96 t ha⁻¹, whereas the above and belowground woody carbon stock, Litter, herbs and grasses (LHGs) and soil organic carbon were 21.92, 5.90, 159.46 and 1.18 t ha⁻¹. The mean aboveground woody carbon stock of the study area is low which indicates that better woody plant species conservation and management like intervention of community-based conservation are recommended to sustain habitat health and enhance the carbon stock of the study area.

Keywords: Aboveground woody biomass, carbon pools, LHGs carbon, Belowground woody biomass

MSc. In Climate Smart Agriculture



ABERU ABEBE

“The most rewarding things in life are often the ones that look like they cannot be done”.



BAYUSH LEGESSE

“Challenges are what make life interesting, and overcoming them is what makes it meaningful”.



KASSAHUN TADESSE

“You may encounter many defeats, but you must not be defeated. In fact, it may be necessary to encounter the defeats, so you can know who you are, what you can rise from, how you can still come out of it”.



MAHINDA BETTY WANJIKU

“I almost quit; I am glad I didn't. Nothing prepares you for the in between being enrolled for a Master's degree and your Graduation day. ACE Climate SABC has molded me into an all rounded person... Tough, a positive outlook on life, boundless mindset and most importantly a Climate Smart Agriculturalist.”

MSc. In Climate Smart Agriculture



MARRIE GRACE NTEZIMANA

Congratulations!



QUINTER AKINGI OGINGA

“A once in a Lifetime Worthwhile Experience. Amasegnalehu”.



THELMA NJAWA MWILA

“I will always remember Haramaya University for its Serene Environment Conducive for Studies and the ‘Macchiato’”.

Wishing you all the Best



Graduates of 2021

MSc. In Biodiversity & Ecosystems Management



UWIMBABAZI AGNES

“African women in science, let our limit be the sky”.



KIDIST TESHOME

“I love You, Ooh Lord, my strength”.



JOHVANIE MUKANKUBANA

“Thank you Lord for your mercy on me by guiding me to achieve on this Postgraduate Degree. I am proud to be a graduate”.



JOSINE TUISHIME

“Though it was not easy, we finally made it!!! Glory be to Almighty God”.

MSc. In Biodiversity & Ecosystems Management



VIOLAH KISHOIN

“Stephen Covey in his book about the 7 habits of highly effective people opined that we should always begin with an end in mind. As I embarked on my learning journey back in 2018, the end for me was the graduation day. As I looked back on graduation day, I couldn’t help but be thankful for the opportunity to study in Haramaya University. I have acquired knowledge and skills that I believe has contributed to transforming me to be a better professional and a problem solver. My hope is to work for the community and contribute to solving some of the environmental issues that society is currently grappling with”.



VIRGINIA MUMBUA

“I have experienced both good and bad while in school and I will cherish these memories. Looking back, it was all worth because I’m ready for another adventure...Shout out to the new graduate in town; that’s me!!!”



ZINASH FITALA

“All is done by Him and His Mom”.



Congratulations to all Graduates of

2021

Selected Students' Case stories

In Ethiopia, particularly in Eastern part where I have been based, the people are very welcoming and warm.

”

Violah Kishoin, Kenyan



My name is Violah Kishoin, a Kenyan by nationality. Before joining Haramaya University in November 2018, I had graduated from Egerton University with a Bachelor of Science degree in environmental science in 2014. And afterwards, I worked in a couple of non-governmental organizations, my latest work place was at Village Enterprise. I am passionate about environmental conservation and I hope to be among the thought leaders in this field as we seek to achieve sustainable development.

Here in the Africa Center of Excellence for Climate Smart Agriculture and Biodiversity Conservation, I studied Masters in Biodiversity and Ecosystems Management. I got a warm welcome when I got here and this made me feel at home and be ready to embark on the journey of learning at Haramaya University. Haramaya University is known to be among the best agricultural universities in the horn of Africa. That was exciting to get trained in the best institution.

Haramaya University provides a good environment for learning as it is well equipped with resources. For instance, the post-graduate library has up-to date books and hence as students, we were always in touch with what is happening. Similarly, the Internet coverage is everywhere in the campus and this makes it easy to do assignments or online related research activities. Haramaya University has also a very beautiful environments with well-maintained Lawns and Trees. This made my evening walks very consistent as the beautiful scenery

acted as a good motivation.

My learning experience in Ethiopia has been one of a kind and I can best describe it as an experience with a few challenges but full of connection and fulfilment. Particularly, learning here, presented a good opportunity to interact with students and Professors from different countries. These interactions have been so enriching and eye opener, as we got to share learning from our different perspectives.

Cultural barrier did not affect my learning in any way. This is majorly because we got an opportunity to be trained by some of the most seasoned instructors and they used an integrative approach to deliver their contents. That way, most of the things became relatable, and I didn't at any point in time, felt out in the conversations and/or discussions.

In Ethiopia, particularly in Eastern part where I have been based, the people are very welcoming and warm. I can gladly say I found a family within this community of lovely people. I will forever treasure the moments my classmates and/or instructors would invite us to their home to enjoy chicken stew (DOROWAT). This was so special to me.

The whole of this master's program i.e. both class and research work have been both challenging and fulfilling at the same time. Challenging in the sense that I was expected to learn and grasp of the new concepts. This made the learning very fulfilling because I had to have an open mind



Haramaya University provides a good environment for learning as it is well equipped with resources.

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and willingness to learn all the time. My Professors also made my learning easier because they mostly delivered their contents hands on. For example, some technical course units such as statistics and ecological modeling were made “easy” to grasp because we learnt by doing them. Additionally, doing assessments and presenting them in class made it sure we understood the different concepts taught in class and also built our public speaking skills.

Coming to my research experience, the field data collection presented an opportunity of implementing what I learnt in class in the practical field setting. Data collection exercise is very challenging and it needs a lot of hard work and overcoming so many obstacles. My research experience was a roller coaster full of ups and downs. The experience inculcated in me, the value of patience and persistence. Some of the challenges during my research included unfavorable weather, lock down due to COVID-19 and lack of cooperation from some local administration authorities. Regarding to challenges posed by unfavorable weather, I organized myself by data collection schedule such that I would go to the field very early in the morning, and avoid day time when the sun was too hot. Similarly, I had to get clearance from all the relevant authorities to ensure smooth data collection.

One of my biggest achievements is the fact that I have finally graduated amidst all the challenges en-

countered on my way. Living in a totally different country means adjusting to everything, the weather conditions, learning the culture, language and getting used to eating the local food. Nothing prepared me to getting used to all those experiences, but having an open mind helped me to cope with everything I needed to.

I would say taking a day at a time really helps in unpacking and adjusting to everything slowly. Obviously, the systems and the way things are done in my country and in Ethiopia are totally different, hence taking time to learn the systems here makes the transition a little bit easier. Learning the value of patience is very essential, somethings don’t move as fast as we would wish and the best one can do is just to wait. Additionally, there are so beautiful things to learn about in Ethiopia, hence, focusing on the positives ensures that the negative energy is kept at bay.

I intend to be among the thought leaders in matters of Biodiversity conservation. And as part of contributing to solving some of the global environmental issues, my first step would be disseminating my research findings to the relevant authorities. I believe these findings would prompt actions by these authorities to develop solutions. What is more, I intend to continue my research work because I believe finding the root causes of some problems makes it easy to bring about solutions for the problems.

Selected Students' Case stories



Before joining the Center, I had a pleasure to be teacher of biology and chemistry at Centre scolaire Nyange and female volunteer in Sabyinyo Community and Livelihood Association where I participated in different projects related to reducing the threats to fragile ecosystem and Volcanoes in National Park, Northern Rwanda. Through this opportunity, I have experienced that biodiversity is highly being threatened under changing climate in tropical regions and that a woman can play a significant role in conserving biodiversity, teaching new generation and maintaining important indigenous knowledge for sustainable biodiversity conservation for the present and future generations. This motivated me to pursue a masters course in the field of natural resource management or environmental science in order to extend my significant contributions in sustainable biodiversity conservation.

Informed by my elder brother, I came to know the Center through the IUCEA scholarship call for application and I tried to apply to different universities. By chance, I was admitted and awarded a scholarship by Haramaya University and now I completed my MSc degree in Biodiversity and Ecosystems Management. Arriving at Haramaya University, I was hosted well in fully equipped hostel with full Internet helping me to read materials online and being able to accomplish my school duties and I was also aided to acquire basic needs to be integrated in new life style (shopping, resident permit, sim card...). The theoretical knowledge I acquired in class was supplemented by field trips in different parts of Ethiopia

and identify how people are using indigenous traditional climate change mitigation and adaptation methods. As a high school teacher who wishes to become a lecturer in university, I have got a model of Student-Centered Learning Methodology acquired from Ethiopian and abroad lecturers from different countries like USA, South Africa and India.

The first challenge to me was the hot and dry weather conditions causing water shortage. The language barrier outside the university during shopping was another challenge, but the adaptation was quick due to the aid of good and hospitable Ethiopian people. My adaptation to Ethiopian food was not easy, however, I had enjoyed it. Interaction with other Haramaya University students, especially the undergraduates, was poor due to language barriers as Amharic and Afan Oromo are dear to them.

After the completion of my study, I would like to be a lecturer in university. Using acquired knowledge, skills and experience, I hope I will provide a better education to students. Also, as a member of Sabyinyo Community and Livelihood Association, I will contribute more in writing grant winning proposals related to biodiversity conservation for better livelihood of the local people. My happiness extends my imagination because being a woman, I always dream to be. I wish also to continue my study until I will become a professor, the limit is the sky.

I am thankful to Almighty God, ACE Climate SABC management team, Professors and classmates for your support during my stay at ACE Climate SABC, Haramaya University.

My happiness extends my imagination because being a woman, I always dream to be. I wish to continue my studies until I will become a professor, the limit is the sky.

”

UWIMBABAZI Agnes, Rwandese

Selected Students' Case stories



Studied Masters of Science in Climate Smart Agriculture with the scholarship opportunity granted by the African Center of excellence for Climate Smart Agriculture and Biodiversity conservation (ACE Climate SABC), Haramaya University. The University offers a peaceful and conducive environment for learning. The boarding facility and lecture halls provided by Haramaya University are to a good standard. Learning in Ethiopia provided me a good opportunity to experience different African cultures, languages and lifestyles. I did not experience any cultural barrier that would have affected my learning experience during the two years.

The different cultures have, of course, enhanced my learning opportunities from different Professors who have been joining the Center from national, regional and international institutions. Course delivery by faculty members from Haramaya University, universities in and out of Africa provided enriching learning packages. The courses were well delivered and assessed. Field trips, group works, and presentations were common methods of learning and the lessons I learnt. Also, valuable lessons learned from research experience was good organization, flexibility in implementing research activities.

The people, cultures, languages and foods were very new and interesting discoveries for me. Focusing on positive things about people, places and situations have

helped me to get through challenging moments. Interacting with local people and having a good relations with staff and colleagues goes a long way in shaping a meaningful living and academic experience. For me, it was so easy interacting with different people at different levels in the Haramaya University, and now I have many friends.

Generally, finishing the coursework and research within the given period of Two years is great achievement. I am now better equipped with knowledge and skills with which I can contribute to programs and policies in the field of sustainable agricultural production, food security and environment nexus not only in Kenya but also in the region.

Focusing on positive things about people, places and situations have helped me to get through challenging moments.

”

QUINTER OGINGA, KENYAN

The people, cultures, languages and foods were very new and interesting discoveries for me.

”

Selected Students' Case stories



Though challenges are natural in academic life, success is inevitable. ” ”

My name is Kidist Teshome and I am graduated from ACE Climate SABC, Haramaya University, in Masters of Science in Biodiversity and Ecosystems Management.

I was one of the students who have long experience in the Haramaya University that has eased my stay at African Center of Excellence for Climate Smart Agriculture and Biodiversity Conservation. It was so easy for me since I am familiar with the academic culture of the University.

I have a good relationship with regional students. As you know, Ethiopians are very famous in accommodating guests and we have no competent in this respect.

Though challenges are natural in academic life, success is inevitable. Hardworking, patience and determinations have helped me to succeed. I didn't give up to accomplish the things I had planned even under hardships.

I don't forget one of the problems I encountered during my research endeavor on the fieldwork. That was while I was collecting my data, I missed my way to the destination. Some individuals have mistakenly shown me the wrong direction, luckily, the matter has been resolved wisely at the end.

Therefore, as an ecologist, I advise female researchers not lose their confidence when encountering similar incidences. In addition, the community should provide necessary supports and guidances for female researchers travelling to their places for fieldworks.

Finally, I would like to suggest to female students to be more confident and believe in hardwork to become successful in their course work and research projects. I also advise them not to let others to bring them down.

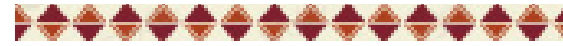
Thank You!!!

We as researchers, must be more confident and believe in working hard, and don't ever let others to bring you down.

” ”

Kidist Teshome, Ethiopian

A picture worth 1000 words!



Congratulations!



Graduates of 2021

Major Achievements and Challenges at the ACE Climate SABC, Haramaya University

Mulugeta Damie (PhD)

Project Manager, ACE Climate SABC



It is indeed an honor to be part of the journey for the last Three years with the regional Africa Center of Excellence for Climate Smart Agriculture and Biodiversity Conservation (ACE Climate SABC) financed by the World Bank and hosted at the Haramaya University, Ethiopia. Thanks to the efforts made by senior faculty members of the Haramaya University together with the seasoned scholars from partner regional and international institutions who paved the way for the establishment of the ACE Climate SABC in October 2017. The Center has made tremendous achievements since its establishment.

The Center has already admitted four batches of qualified and motivated young Africans to its Master and PhD programs. All masters' students in both Climate Smart Agriculture and Biodiversity and Ecosystems Management programs of the Center (i.e. 24 students) have successfully defended their theses and graduated in February 2020. The progress of most the first cohort

PhD students on their dissertation research is quite good and can be defended in open sessions by the beginning of the year that follows if not by the end of this year. Since its establishment Three years ago, the Center has created strong working relationships with several national, regional and international institutions and organizations. The Center has already formalized partnerships with Seven partners that have signed MoUs for better collaborations and networking. Moreover, the Center has supported over Fifty staff/students exchanges most of which were incoming exchange of senior professors to handle both masters and PhD courses since the establishment of the Center.

Though the Center had plans to conduct several short-courses identified from the outset, it was able to deliver only few of the courses mainly due to the delays in the release of the project budget in time. For the last one year, the Center's activities, such as the delivery of short courses, convening conferences, conducting

teaching-learning, and student research have been severely affected by the arrival of the noble corona virus. Following the lockdown, faculty members of Haramaya University and PhD students of the Center could not travel to other places on exchange and faculty members and PhD students of other universities/centers could not come to ACE Climate SABC for exchanges. Travel suspensions imposed by governments due to the outbreak of noble corona virus impacted the progress of students on coursework, field visits and research.

There were also other factors limiting the effectiveness of the Center in achieving some of the key results planned to be achieved during the implementation period that was already lapsed. One of these factors is the high staff turnover. Recently, the Center has recruited its Third finance officer in its span of Three years. The positions of the Communication Officer, Center Leader, the Project Manager, and Training and Research Head were refilled with

The Center has already formalized partnerships with Seven partners that have signed MoUs for better collaborations and networking.

”

replacements. The staff turnover has had a debilitating effect on the efficient flows of the activities of the Center for replacement of positions by new staff always requires the newcomers to have induction periods to adjust to new working environment.

The second major challenge is the low level of motivation of middle level management, affiliated faculty members, and other support staff to show the spirit of ownership of the Center and reluctance to fully cooperate towards effective implementation of work plans. This is mainly due to lack of adequate incentive packages for participation in project activities. The sluggish process of transferring stipends and research fund for regional students to their home countries is another challenge. The National Bank of Ethiopia (NBE) sometimes, take long time to effect transfers of stipends and research funds from the date of submission of the requests. In some cases, the Bank rejects our requests for minor reasons. The delay in the transfer of the money has a significant effect

on the students' livelihoods and the progress of their research work.

The Center works tirelessly to overcome these challenges. It has put all the necessary precautions to prevent the faculty members, students and project staff from getting contact with the noble corona virus. The Center provides face masks and hand sanitizers to students, faculty members and project staff members regularly. Classrooms, corridors and offices are disinfected with chemicals. Hand washing points were established at the gate of the Building where offices and classrooms of the Center are housed.

In order to overcome the challenges it faced in relation to staff/student exchange, the Center is currently encouraging affiliated faculty staff to go out on exchange to local universities to either handle courses or conduct research or do both in collaboration with staff/students of the hosting universities.

The Center is closely working with

the concerned staff members of the NBE to at least reduce the time it takes to transfer stipends and research funds to the regional students of the Center so that the students can focus on their research activities than to waste their time in repeatedly requesting the status of the transfer requests laying on tables at the Bank.



Project communication Challenges and Ways out

By Gizachew Nemomsa (MA)

Communication Officer, ACE Climate SABC



Communication is an integral part of any organization. It can determine the life span of any project. A project communication is guided by strategic plan that is designed by communication professionals. Wisely designed communication strategy makes a project successful in achievements of its goals. Though they are common to any form of communication, poor planning, ineffective messages, organizational problems, language constraints, and style and skills are referred to as general communication barriers in organizations.

To be successful in any aspects of project communication, any organization that runs projects should understand three basic challenges and the ways to tackle the challenges.

The first challenge of project communication is failing to live up to the commitment for good communication. That is expressed in

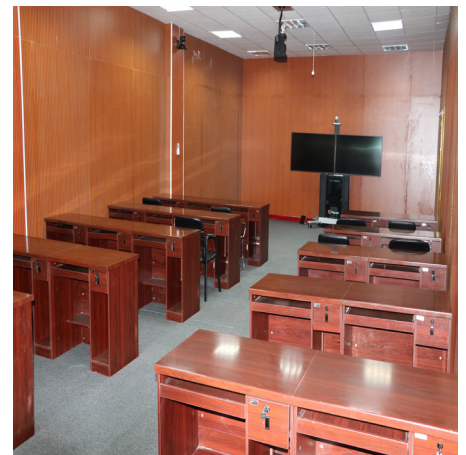
how to consistently communicate within a team, with the leadership, and across the organization as a whole which is very essential for the projects' success. When the project is running full steam, communication with team members, up the ladder to the leadership or out to other employees may be inconvenient. The solution to tackle this challenge is committing to communication schedule, being reliable even when time seems better spent elsewhere.

The second challenge comes from the onlookers and the micromanagers who ask for every detail of the work being done even though they are not on the project team. Project team can get derailed when those outside the team constantly ask for detailed information on progress, problems and the like. It is obvious that with any project comes change, and with change comes feeling of a loss of control. Therefore, they need every piece of information to get

some sense of power and control. The solution for this inevitable challenge in project communication is to pledge to a regular method and format of communication and guide those asking for more detail back to that communication, i.e don't let those who are on edge lead you off track.

The last, but not least challenge is disorganization and its impact on communication. A project team must establish the tools and methodology to get the work done, including management of their team meetings. Without a clear set of tools and rules to assure that the team meetings are productive and communication lines are easily established, the team flounders. To get out of this challenge, it is crucial to develop meeting guidelines and tools, and state to them, in order to give the team members, the knowledge and clarity to get their questions answered and their works done.

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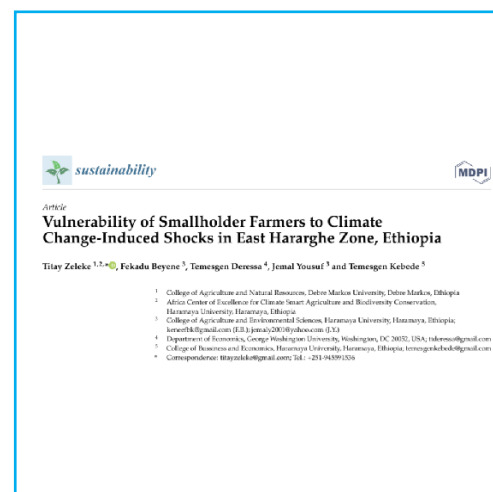
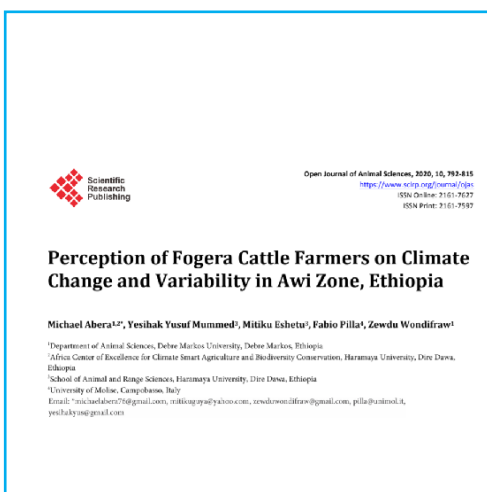
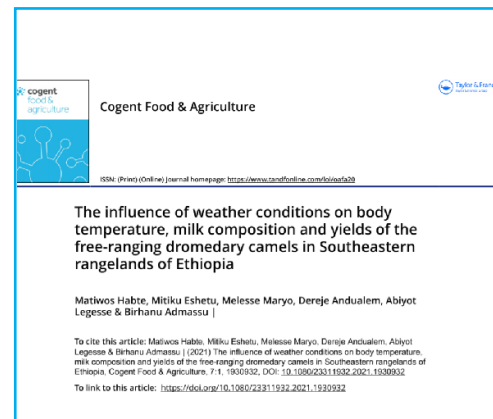
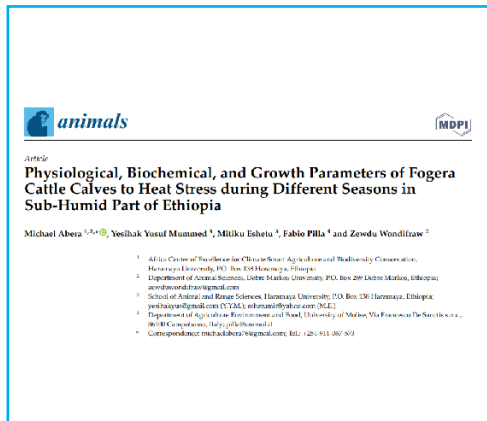
ACT African Conservation Tillage Network
Conservation Agriculture for Improved Livelihoods and a Better Environment



Aqua Soul, Water Purifying Factory,
Dire Dawa, Ethiopia

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A glimps into some of the ACE Publications in different Journals



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Congratulations!





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