

To: Dean of International Relations, IIT Kharagpur

Dear Sir/Madam,

RE: The statement of Purpose of PhD Studies for Mr. Prosper AYABAGABO

Drought events are recurrent over the East Africa. Drought events have seriously affected the agriculture, food security and livestock of the East Africa countries, namely: Kenya, Somalia, Uganda, Tanzania, Burundi, Rwanda, Ethiopia, South Sudan, Sudan and Djibouti in the last four decades. The east Africa have two distinct parts namely: the Horn of Africa and Kenya characterized with a low rainfall and highly variable (24%) and another part characterized by high rainfall indices and low variability. The East Africa population is estimated at around 330 million and the region dependent highly on rainfall to feed its increasing populations. According to Richman *et al*, 2016 severe droughts caused crop failure, and affected 90 millions of people in Ethiopia and the Ethiopian famine of 1983 – 1985 caused loss of ~ 400,000 to 1,000,000 lives. The east African drought of 2010 – 2011 events are among the severe one, the droughts of 1973 and 1984 was also remarkable in Kenya and Ethiopia.

Severe drought events in the year following the El Nino episodes of 1997/1998 in 1999/2000 caused disastrous events in the eastern of Rwanda including loss of lives. According to Mikova *et al*, 2015 during the years 1982/83, 1991/92, 1999/2000, 2005/2006, 2008, and 2009 drought occurred in Rwanda with serious negative impacts on crop production and food security. Funk *et al*, 2014 mentioned that poor boreal spring rains was also observed in 1999, 2000, 2004, 2007, 2008, 2009 and 2011 over southern Ethiopia, eastern Kenya and southern Somalia regions.

According to FAO (2016), drought have affected over 157 million people in the East African countries from 1971 and more than 91 million from 2000 to 2015 only. Again, crop and livestock losses have reached 4.9 billion USD between 2003 and 2013 over the region.

According to Gebremedhin *et al*, 2019 during the last two decades, both the frequency and severity of droughts have shown an increase in the East Africa. Again, the duration and the area impacted by drought have also increased significantly in the region. Furthermore, he mentioned that studies done on the East Africa Droughts lacks the information on evolution, complexity, social implications and people's vulnerability. Nicholson, 2017 indicated that drought have become longer, more intense and tend to continue across rainy seasons and their causes are not adequately understood over the East Africa. Hence, there is a need to understand the magnitude and evolution of drought in terms of the near present and future drought in order to inform mitigation measures and strategy development.

During Master's degree studies in Meteorology thesis at the University of Nairobi, Kenya I focused the research on seasonal rainfall variability and its effects on major food crop yields variability in Rwanda. The research used rotated principal component analysis for homogeneous rainfall zones delineation on historical observed rainfall data from 1981 – 2017 over the study area, standardized precipitation indices to characterize rainfall amount, distribution and frequency as well test of the trend in rainfall using the Mann Kendall and Sen's slope estimates. The Aim of the PhD Studies is to characterize the past and future drought up 2100 over the east Africa region using the Regional Climate Model (RCMs) data available under Coordinated Regional Downscaling Experiment (CORDEX) of the World Climate Research Program (WCRP) and the Development of Future Scenarios. The study will use the multi model and multi index approach such as the Drought Reconnaissance Index (DRI) and Standardized Precipitation-Evapotranspiration Index (SPEI) among others to characterize past, future drought and discrepancies between historical and future drought events. Future Scenarios will be based on two Representative Concentration Pathways (RCPs) namely the RCP 2.6 and RCP 8.5, which corresponds to scenarios of comparatively low and high greenhouse gases emissions respectively. The models data will be validated against the historical Climate Hazard Infrared Precipitation with station (CHIRPs) dataset from the IGAD Climate Prediction and Application Centre and Climate Reference Unit (CRU) dataset on Temperature. The discrepancies or bias between the model and observations will be adjusted using the quantile mapping approach.

The study will contribute to knowledge on the performance of Regional Climate Model over the study area as well as on the early warning system for drought monitoring and forecasting and it will inform decision makers on future possible drought characteristics so that they can develop strategy or mitigation measures.

Sincerely yours,

Prosper AYABAGABO