Potential response of Tea production to climate change in Kericho County

Okoth, George Kabaka

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Abstract:

This study assessed the potential impact of future climate change on tea production in Kericho County based on the PRECIS Regional Climate Model outputs. Climate change is of concern due to the vulnerability of natural resource and especially agricultural activities in developing countries to climate variability. Agriculture in developing countries is characterized by reliance on natural climate conditions, and the sensitivity studies have shown the response of agriculture to climate variability, tea production in Kenya is no exception. Intergovernmental Panel on Climate Change (lPCC) asserts that the present vulnerability to climate variability can be exacerbated by future climate change from increase in the intensity and frequency of climate extremes. Tea productions in Kericho contribute to national development through creation of employment opportunities, foreign exchange earnings and contribution to the national gross domestic product (GOP) of Kenya. This study therefore aimed to address the following questions: what were the trends in rainfall and temperature Kericho County? Is the (Providing Regional Climate for Impact Studies) PRECIS regional climate model able to accurately simulating climate of the area? What was the relationship between tea production and climate of the area? What is the possible future climate condition of the area and the potential impact on tea production? Focussing on these research questions, the research aimed to determine the climate trend over Kericho in the near past, determine the skills of the PRECIS model to simulate the climate of the region, establish the relationship between tea production, and climate and eventually to provide the future climate scenario and determine how it may influence tea production. The data used in the study include: observed monthly rainfall, maximum and minimum temperature for Kericho obtained from Kenya Meteorological Department; Tea production data for Kapkatet tea Factory obtained from Tea Board of Kenya; PRECIS model output data (mean monthly rainfall, maximum temperature and minimum temperature) which was obtained from Inter-Governmental Authority on Development Climate Prediction and Application Center (lCPAC). The research was conducted on seasonal time periods with two peak production periods and two low production periods. The methods for analysis included time-series plots, graphical methods, correlation analysis, regression analysis, root mean square error analysis, ttest, and categorical statistics. The data showed an increasing trend in maximum and minimum temperatures in most of the seasons. Rainfall was found to decrease for most of the rainfall and tea production seasons except for the December- January season which showed an increasing trend in the recent past. To determine the relationship between tea production and each of the climate variables in Kericho for the four production seasons: February-March and July-August (low production season), and April-May and October-December (high production seasons) the correlation analysis and regression analysis was used and then subjected to t-test for significance. The data indicated a correlation coefficient >0.5 for most of the seasons except for

rainfall and minimum temperature in April-May season. The coefficients of correlation were found to be significant at 95% significance level. The PRECIS model was found to sufficiently simulate the climate of the region by exhibiting a significant correlation coefficient with the observed data, and also the Root Mean Square Error (RMSE) values obtained were reasonably low when model data was compared with the observed data. This indicated that the PRECIS was to some extent accurate in capturing the climate of the study area hence its suitability. The model was however found to overestimate the minimum temperature although its precision in capturing the trends for minimum temperature was quite significant. The climate projections from the simulated climate change scenarios A2 for the Kericho area show increasing trends rainfall for the periods 2030, 2050 and 2070. The short rains (September-December) show more increase as compared to the long rains (March-May) seasons .: The June-August rainfall also indicated an increasing trend and so did the annual mean rainfall. The projection indicated an increase in the mean annual maximum temperatures and minimum temperatures for the period 2030, 2050 and 2070, the increase is however lower especially for the periods around 2030 as compared to the period 2050 and 2070 . The results for the response of tea production to the projected climate scenario vis-a-vis the relationship determined in the regression analysis showed that the increase rainfall and minimum temperature especially for the long term period around 2070 had a potential to increase tea production. However the increase in maximum temperature was found to create a potential decrease in tea production in most of the tea growing seasons in Kericho County. On the basis of the findings it is concluded that the climate of Kericho has been changing in the past and will probably change in the future. Considering that climatic factors are important in explaining tea production in Kericho County, the change in the climate will affect tea production in the future. Arising from the study, it is recommended that necessary climate adaptation strategies need to be put in place in the tea sector, it is also necessary to promote the use and access to climate modeling in the region. There is also need to maintain and allow easy access to quality agriculture and climate databases. The study recommends further studies on appropriate adaptation strategies in the tea sector in the country. Studies on the use of an integrated climate impact analysis on agriculture in the region, which takes into consideration such factors as socio-economic, environmental, ecological, and management practices.