Forests play a significant role in the mitigation of climate change and improving livelihoods of people directly and indirectly across the world. Kenya's closed forest canopy is less than 2%'as compared to 9% and 21% for the rest of Africa and the world, respectively. The Government of Kenya Forest Act 2005 envisions achieving 10% forest cover through various forestry programmes with farm forestry- seen as the main viable option. Statistical models have proved to be useful tools in studying the cause and effect relationship that could lead to insights regarding determinants of tree retention on farm for improvement of forest cover and carbon sinks. However, little has been done in the assessment of tree recruitment, survival, carbon estimation, carbon market and factors associated with tree retention on farm. The objectives of this study therefore were to: detennine the recruitment, survival and carbon quantification of commonly grown plantation tree species *(Pinus patula, £ucalyptus saligna, Cupressus lusitanica* and *Juniperus procera);* evaluate income from carbon credits in comparison with sale of wood and analyze determinants of tree retention on farm.

The study was carried out in Kiambu and Nyeri Counties covering Lari, Kikuyu, Nyeri South and Nyeri North districts in Central Kenya. Retrospective longitudinal approach for seedling distribution data from Kenya Forestry Service (KFS) and sampled group of nurseries were used to model the trend of seedling recruitment. A list of gazzetted plantation forests was drawn in which stratification and simple random sampling were used in selection of forest stations and species. An inventory data of 2009 from sampled forest stations were used to model the tree mortality of the selected species. Temporal plots were established in the sampled plantations for carbon assessment. Stratification and simple random sampling procedures were used to select farm household in the baseline survey for assessment of tree retention determinants. Seedling distribution data were analyzed using time series (Autoregressive Integrated Moving Average-ARIMA) and linear mixed models. Mortality data were analyzed using survival models. Linear mixed and generalized regression models were used for analysis of carbon estimation and income in comparision with wood sale. Chisquare, Mann Whitney U, Kruskal Wallis H tests, analysis of variance, binary and multinomial logistic regression models were used for analysis of survey data on tree retention determinants.

There was a significant decreasing trend on tree rectruitment on farm and gazzetted forests. ARIMA models significantly ($p<0.01$) fitted the data. *Cupressus lusitanica, Pinus patula* and *Eucalyptus saligna* were the dominant tree species planted and had better survival. *Eucalyptus saligna* had highest amount of carbon sequestered belowground and above-ground (247.9 ± 44.4 MgC ha-l) followed by *Pinus patula* (145.6 ± 44.4 MgC ha" and *Cupressus lusitanica* (98.4 ± 44.4 MgC ha"). Income realized from sale of wood as compared to expected carbon credit for above ground biomass was higher. However, with inclusion of soil carbon, expected carbon credits were higher than sale of wood. Study sites, gender of HH, income, land size, age, education, occupation, technical skills, harvesting regulation, extension services and labour, significantly influenced farmer's lifetime value to retain trees on farm. Overall statistical modelling was found useful in identifying suitable determinants of forest cover and carbon sequestration.The study recommends acquisition of more data to maximize the use of time series models on forecasting of seedling recruitment for improvement of forest cover. It also emphasizes the need for developing biomass equations of commonly grown plantation species and trees on farm to improve accurate estimation of carbon sequestration in Central Kenya.