

## ABSTRACT

The attainment of green economy and low carbon climate resilient development in Kenya may be hindered by competing human interest on forests and other natural resources. Eastern Mau forest has experienced anthropogenic disturbance through encroachment and forest fires; that situation prompted the deployment of heterogeneous forest management. This study aimed at comparing the soil carbon stocks and soil CO<sub>2</sub> effluxes in different forest management regimes on as well as how soil temperature and soil moisture impacts on carbon stocks and soil CO<sub>2</sub> effluxes in the study area. The study was conducted between January and June 2016 in Sururu block of Eastern Mau forest reserve, Kenya. A nested experimental design was used in data collection; where thirty two sample plots were nested into four blocks (disturbed (fire) natural, undisturbed natural, plantation and glades) established on the basis of forest management types. In a 10m<sup>2</sup> plot, data was collected on soil carbon stocks, soil CO<sub>2</sub> efflux and environmental controls (soil temperature and soil moisture). The results indicated that estimated soil carbon stocks were as follows: undisturbed natural (135.17± 35.99.0 Mg C-ha), disturbed natural forest by fire ( 134.52± 38.11 Mg C-ha) glades (122.4 ±64.9 Mg C-ha), and plantation forest (116.51± 39.77 Mg C-ha ). However, there were no significant differences in the mean carbon stocks between the four forest management regimes (F<sub>4</sub>, 16. =0.61, p=0.613). The mean soil CO<sub>2</sub> efflux between the four forest management types was significantly difference (F<sub>1</sub> 32. =3.01, p=0.033). The soil CO<sub>2</sub> efflux levels recorded were as follows; plantation forest (9.219 ± 3.067 g C M<sup>-2</sup>day<sup>-1</sup>), undisturbed natural forest (8.665 ± 4.818 g C M<sup>-2</sup>day<sup>-1</sup>), glades (8.592 ± 3.253 g C M<sup>-2</sup>day<sup>-1</sup>) and fire disturbed natural forest (7.198 ± 3.457 g C M<sup>-2</sup>day<sup>-1</sup>). Based on the results; forest disturbance impacts on soil stocks and therefore for Kenya to achieves its Nationally Determined Contribution (NDC) targets of reducing Green House Gases(GHG) emission by 30% relative to business as usual (BAU) emissions of 22 MtCO<sub>2</sub>e in 2030, natural forests and glades management regimes presented the best options. Therefore the use of natural forest management regimes in the conservation of soil carbon stocks and in reducing carbon dioxide efflux from the forests is recommended. Additionally a paradigm shift in forest management to include management for non wood forest products and service such as carbon stocks and climate stabilization is needed. Finally REDD+ process in Kenya should consider the carbon stored by forests in its reference level establishment.

## Keywords

Eastern Mau forest