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Quantifying the environmental impact on coconut cultivation in the low country intermediate zone of Sri Lanka

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Among the critical environmental impacts, the effect on climate change in terms of carbon dioxide emission and the impact on water resources in terms of net water recharge are of paramount importance. Environmental impact indicators provide information to comprehend the extent of the impact on the environment. Eco-verification of agricultural production using environmental indicators is important for understanding its sustainability and to claim premium prices for agricultural products. Among the plantation crops grown in Sri Lanka, coconut is the most widely grown crop with strong social, cultural, and economic ties to the Sri Lankan people. The present study attempts to quantify the environmental impact of coconut cultivations in the low country intermediate zone in Sri Lanka. The impact was objectively evaluated using Combined Environmental Impact Indicator (CEII) which consists of two indices, i.e. Carbon Sequestration Index (CSI) and Water Recharge Potential (WRP). CSI was calculated by determining the total carbon sequestration and dividing it by the total carbon emission by the plantation. Total carbon sequestration of coconut plantations in the intermediate zone was 26.39t C $ha^{-1}yr^{-1}$. Based on previous findings, the average total carbon emission of coconut plantations has been calculated to be 0.1176t C $ha^{-1}yr^{-1}$ in the intermediate zone. Therefore, the CSI was calculated as 224.24 and the scale score was 3 for CSI, which indicates a significant positive impact in terms of carbon sequestration. (CSI<0 scored as -2; significant negative impact, 0<CSI<1 scored as -1; negative impact, CSI=1 scored as 0; no impact, 1<CSI≤100 scored as 1; some positive impact, 100<CSI≤200 scored as 2; positive impact, 200<CSI≤300 scored as 3; significant positive impact). WRP was calculated by determining the drainage, and taking the ratio of drainage and the rainfall in the considered area. According to the previous studies the drainage was indirectly estimated to 1171 mm yr^{-1} and the average rainfall was quantified to 1701 mm yr^{-1} for the intermediate zone. Therefore, the water recharge potential of coconut plantations was quantified as 0.68 and the scale score was 1 for WRP, which indicates a positive impact on groundwater recharge in the scale of 0≤WRP<0.2 scored as -2; significant negative impact, 0.2≤WRP<0.4 scored as -1; negative impact, 0.4≤WRP< 0.6 scored as 0; no impact, 0.6≤WRP<0.8 scored as 1; positive impact, and 0.8≤WRP<1 scored as 2; significant positive impact. Finally, the CEII was developed by adding the CSI and the WRP together. Therefore, the CEII was quantified as 4 (CSI=3, WRP=1), which indicates a significant positive impact on the environment. These results could be considered as the first approximations of impact assessment of coconut plantations in the intermediate zone, and further verification is needed for other regions.

Keywords: Carbon sequestration index, Coconut, Environmental impact indicator, Groundwater recharge