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Farmer perception and adaptation to climate change in homegardens of Sri Lanka

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Homegarden (HG) agro-ecosystems are agroforestry systems in Sri Lanka that covers about 14% of the total area of the country. The HGs that are characterized by a high species diversity are viewed as resilient to climate change (CC). This study analyzed the changes in climate in two rainfall regimes i.e. dry zone (DZ) and wet zone (WZ) of the country, and examined the adaptation strategies in HGs based on perception of farmers on CC and determinants of the choice of such strategies. The trends in rainfall (average monthly and weekly), and temperature (minimum and maximum) of the selected sites were analyzed to establish CCs over 6 decades. Data gathered by a household survey conducted among 148 HGs (i.e. 59 from Keeriyagawewa (KW) and 30 from Siwalakulama (SK) in the DZ, and 59 from Pethiyagoda (PG) in the WZ were analyzed to identify the socio-economic profile of the farmers and their perception on CC, tree diversity using Shannon-Wiener Index (SWI) in HGs, CC adaptation strategies during past 2 decades and their determinants using a Probit model. The average HG size was significantly different in three study sites (0.83 ac ± 0.042 in KW, 1.01 ac ± 0.05 in SK and 0.46 ac ± 0.078, in PG; $p<0.05$). The SWI was significantly different in SK (1.75 ± 0.067) compared to that of KW (2.13 ± 0.059) and PG (2.00 ± 0.052) ($p<0.05$). Evenness calculated for HGs was not significantly different ($p>0.05$). Twenty eight species were common to all three sites where 23, 28 and 3 species were found only in KW, PG and SK, respectively. The rainfall (Rf) variability has decreased during the past decade, but the variability within a rainy season and number of consecutive dry days have increased with intense droughts and floods during the period 1990-2010. The analysis of temperature data for the same period, considering the minimum (Min) and maximum (Max) threshold for the sites as 25 and 32.5^{o}C (KW), 22.5 and 32.5^{o}C (SK) and 22.5 and 30^{o}C (PG), respectively, indicated that the Min and Max temperatures and the number of warm days and nights have increased, while the number of cold days and nights has decreased. The majority of the HGs consisted of low-income farmers, mainly with primary education. In DZ-HGs, 50% of the respondents perceived that the Rf has decreased and 68% noticed that the pattern of Rf has changed, while in WZ-HG 52% perceived that Rf has increased and 72% indicated that rains come later than the previous year. About 59% of the total respondents have noticed an increase in the day temperature. Of the respondents, 120 (81% of total) have either changed planting dates of crops, introduced new technologies (e.g. new varieties, irrigation techniques), changed agronomic activities or used soil and water conservation measures in HGs during the period 1990-2010. However, only those who changed planting date of annual crops (55 respondents; i.e. 45 in KG, 8 in SK and 2 in PG) adapted the strategy directly responding to CC (i.e. delay in Rf). Respondents with education at least up to primary level and experience in agricultural activities, and those in higher income categories had a correct perception on CC. The diversity and structure of HGs varied among sites, and HGs in KW and PG showed better resilience than SK. The gender and education level of the household head, and location of the HG mainly determined the decision to practice CC adaptation strategies. The study revealed that 19% of the total farmers surveyed did not adapt strategies in HGs to cope up with CC and 44% did strategic changes to the HG agro-ecosystem without due consideration to CC.