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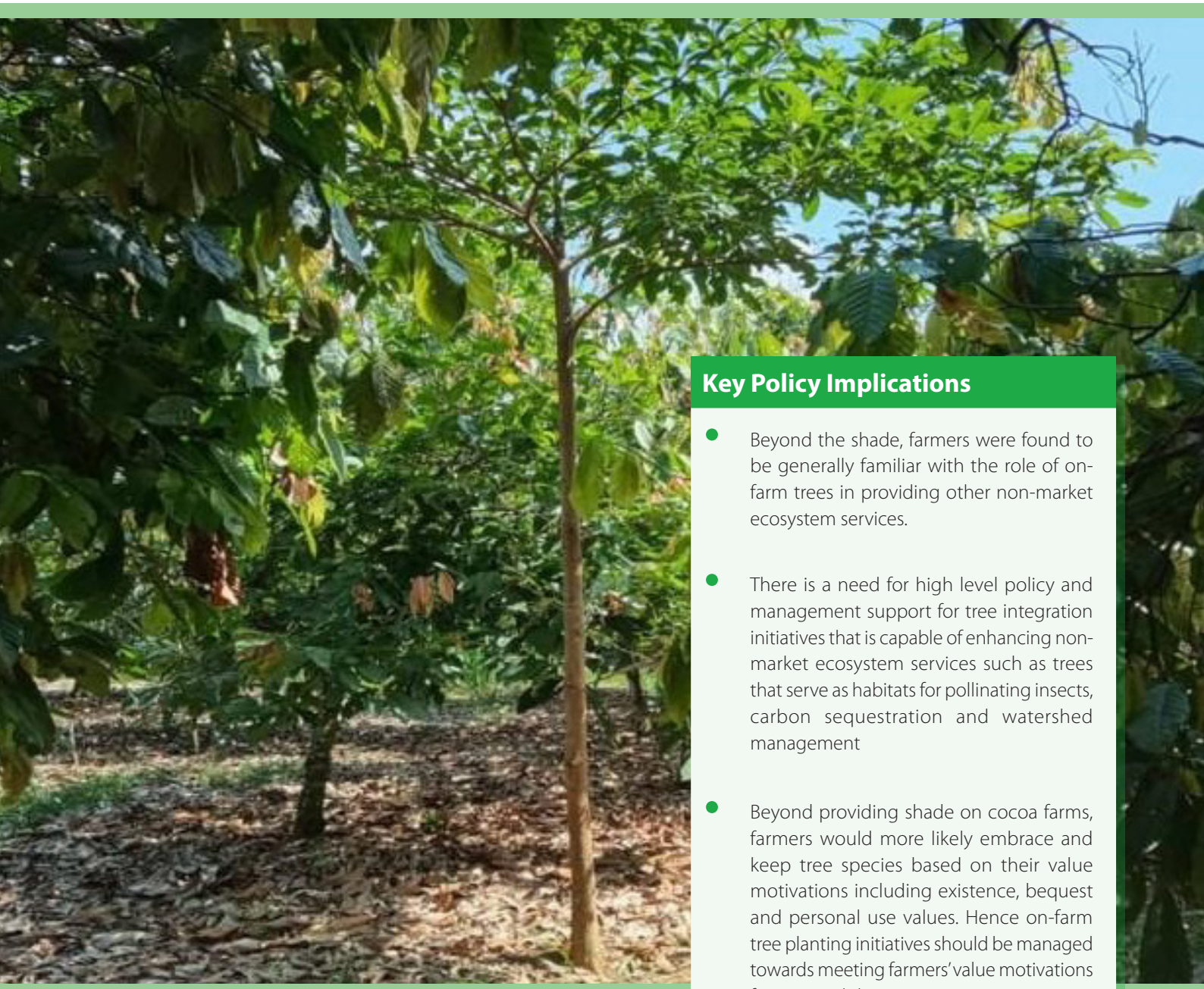

Key Policy Implications

- Beyond the shade, farmers were found to be generally familiar with the role of on-farm trees in providing other non-market ecosystem services.
- There is a need for high level policy and management support for tree integration initiatives that is capable of enhancing non-market ecosystem services such as trees that serve as habitats for pollinating insects, carbon sequestration and watershed management
- Beyond providing shade on cocoa farms, farmers would more likely embrace and keep tree species based on their value motivations including existence, bequest and personal use values. Hence on-farm tree planting initiatives should be managed towards meeting farmers' value motivations for sustainability.

Beyond the shade: How much are on-farm trees worth to cocoa farmers?

Context:

Cocoa, an understory plant, thrives well under certain amount of shade of trees making integrated trees on farms (agroforestry) essential for the sustainability and ecological resiliency of any cocoa farming systems (Asare, 2005; Obeng and Aguilar, 2015). Shaded cocoa agroforestry systems provide both tangible marketable products and intangible ecosystem benefits considered as non-market ecosystem services (Figure 1). The non-market ecosystem services include habitat for pollinating insects, nutrient cycling and maintenance of soil quality, carbon sequestration, aesthetics and recreational services, flood mitigation, erosion control and watershed management that improves agriculture productivity (ten Brink et al., 2011). The economic value of tangible market products from shaded cocoa systems is well known and often reflected in market prices whereas the economic value of non-market ecosystem services is not well documented necessitating research to estimate their value (ten Brink 2011). Managing cocoa agro-ecosystems to optimise ecosystem service provision while sustaining cocoa yield and biodiversity involves decisions on trade-off which requires an understanding of the different drivers for stakeholders' interests and values for different ecosystem services.

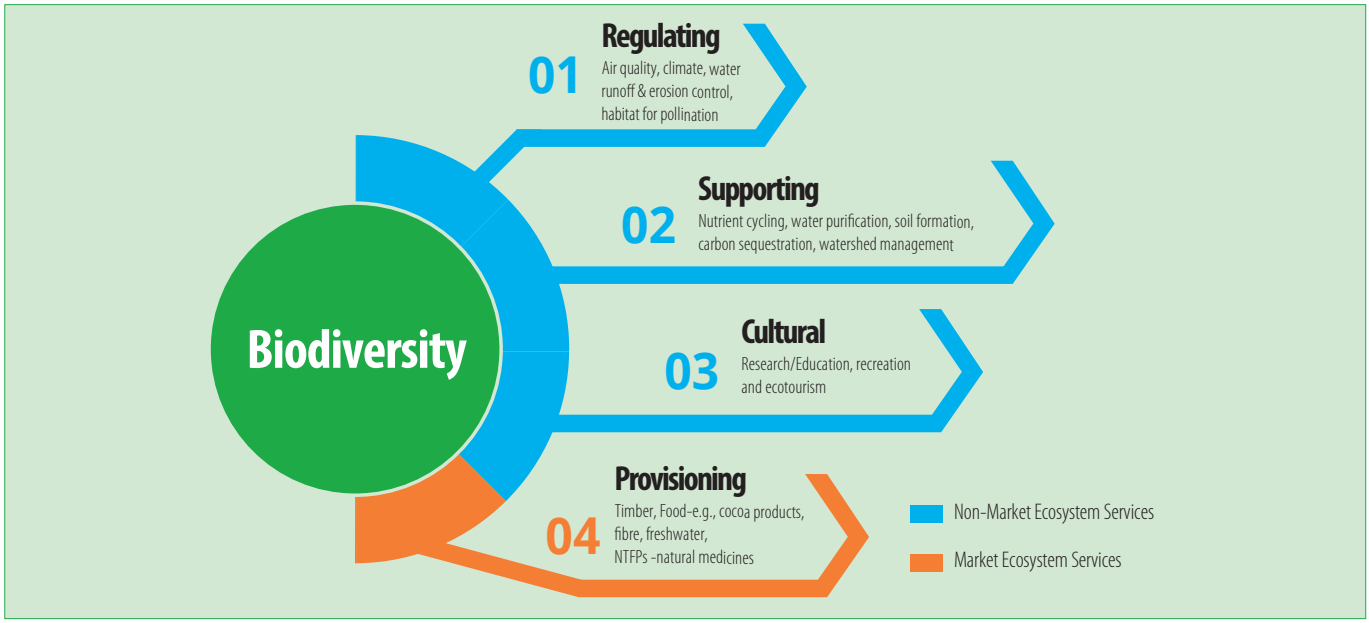

Figure 1: Categories of ecosystem services and biodiversity from cocoa agro-ecosystems (MA, 2005). The total economic values of these services are estimated based on the market and non-market values.

This brief presents empirical findings on cocoa farmers' inherent value motivation for integrating trees on cocoa farms and economic values for the non-market ecosystem services provided by these trees beside shade provision. Information on economic values of non-market ecosystem services plays an important role in informing policymakers about the relative importance of all ecosystem services. Expressing the value of non-market ecosystem services in monetary units help support policy, planning and management decisions that balance the provision of the range of ecosystem services and enable efficient use of environmental resources (De Groot et al., 2012). Furthermore, such information can be useful in developing management policies that encourage ecosystem service co-occurrences in order to avoid undesirable trade-offs between targeted products (services) that may results from the different conflicting landscape sectoral policies and goals (e.g., sectoral policies of Ghana COCOBOD and Forestry Commission).

The study was conducted in ten (10) cocoa farming communities in three forest districts (Juaboso and Enchi in the Western North Region, and Asankrangwa in the Western Region of Ghana) (Figure 2) Data was gathered using a combination of qualitative, quantitative and contingent valuation methods involving a total of three hundred and forty (340) randomly selected cocoa farmers from the three forest districts.

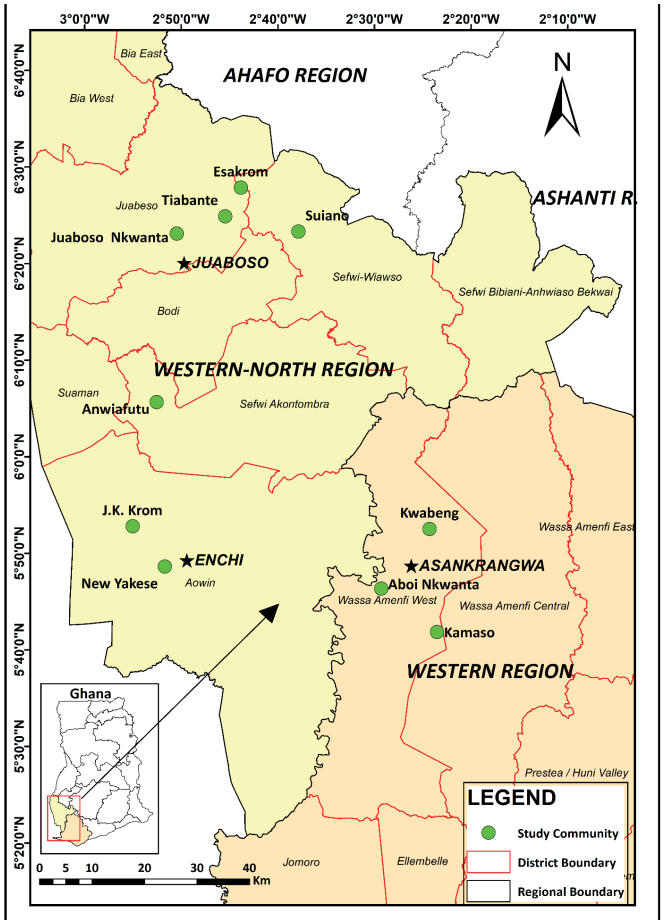

Figure 2 Map of Western north region with location of the study communities in the three forest districts.

Key Findings

Attitudes towards integrating trees on farms and ecosystem services provision

Cocoa farmers' level of awareness was high for five of six non-market forest ecosystem services provided by trees on farms (Figure 3). This means that many cocoa farmers are very knowledgeable about the role of trees in providing non-market forest ecosystem services. Tree's role in protecting rivers and streams from drying up was the services with the highest level of awareness while the role of trees in providing culture and spiritual significance was the service less familiar (mean level of familiarity = 3.55) to respondents relative to the other five services (Fig 3).

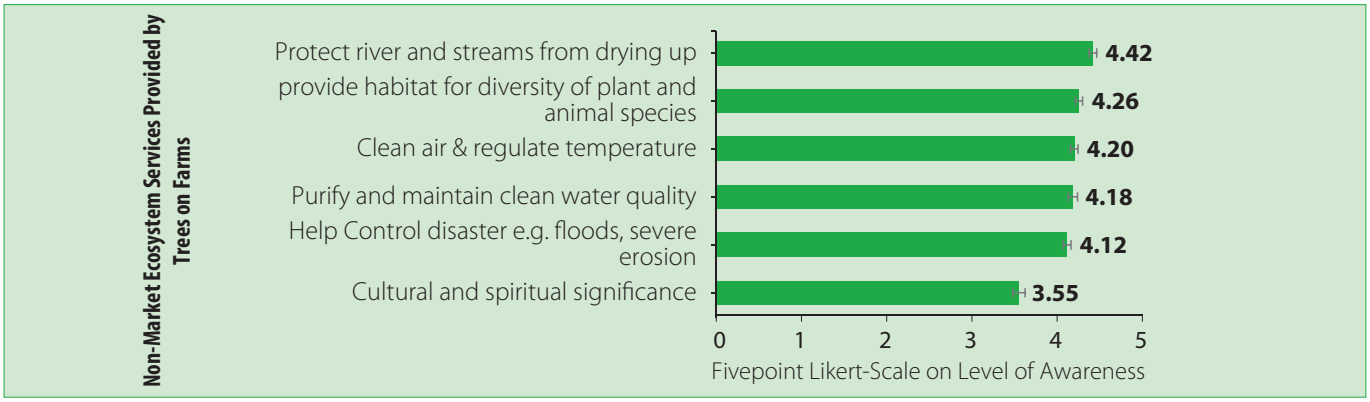

Figure 3: Respondents' level of awareness of non-market ecosystems services provided by trees on farms assessed on a 5-point Likert scale. (1 = I have no idea and have never heard of this role, 2 = I have slight knowledge of this role, 3 = I have moderate knowledge about it, 4 = I am very knowledgeable about this role, 5 = I am extremely knowledgeable about this role).

The respondents reported that their reasons for keeping trees on farms include providing shade for their cocoa and other crops, medicinal purposes, other ecological benefits besides shade and serving as collateral for accessing financial credits (Figure 4). Trees providing shade for crops was ranked by majority of respondents (85.2%) as the most important reason (Rank 1) for keeping trees on farms (Fig 4). This was followed by personal access to timber for wood products including furniture which was ranked (Ranked 2) by almost half of respondents (47.4%). Similarly, approximately 37% and 34% of respondents ranked access to medicinal resources and environmental benefits as the second most important reason for keeping trees on farms respectively. About 26% of respondents also ranked keeping trees for medicinal resources as the most important reason.

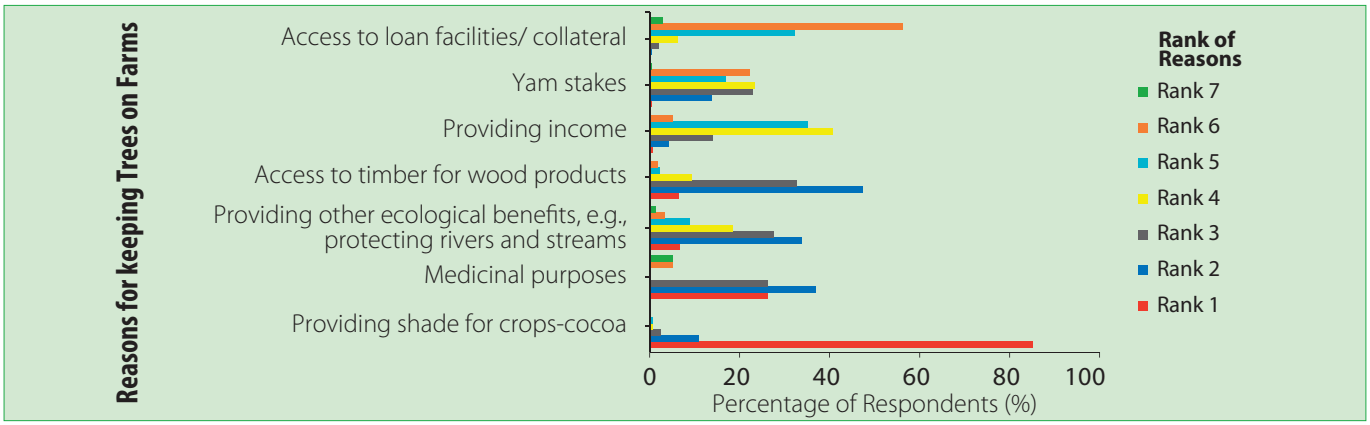

Figure 4: Percentage distribution of respondents ranking of reasons for keeping trees on farms (Ranking is based on 7-point scale of most important reason with 1 being the most important and 7 being least important)

Farmers Value Motivation for Keeping Trees on farms

According to Kengen (1997), many values are inherent to the forest and to what it represents for different people. Economic values are assigned to forest ecosystem services according to their use values (i.e., direct use values, indirect use values and option values) and non-use values (i.e. bequest values, altruist values and existence values) (ten Brink et al., 2011). Conserving forest for its continuous existence was rated as the most important value motivation why farmers would want to engage in on-farm tree integration beyond shade with a mean of 4.6 which denotes "important" on the 6-point Likert scale (Fig 5)

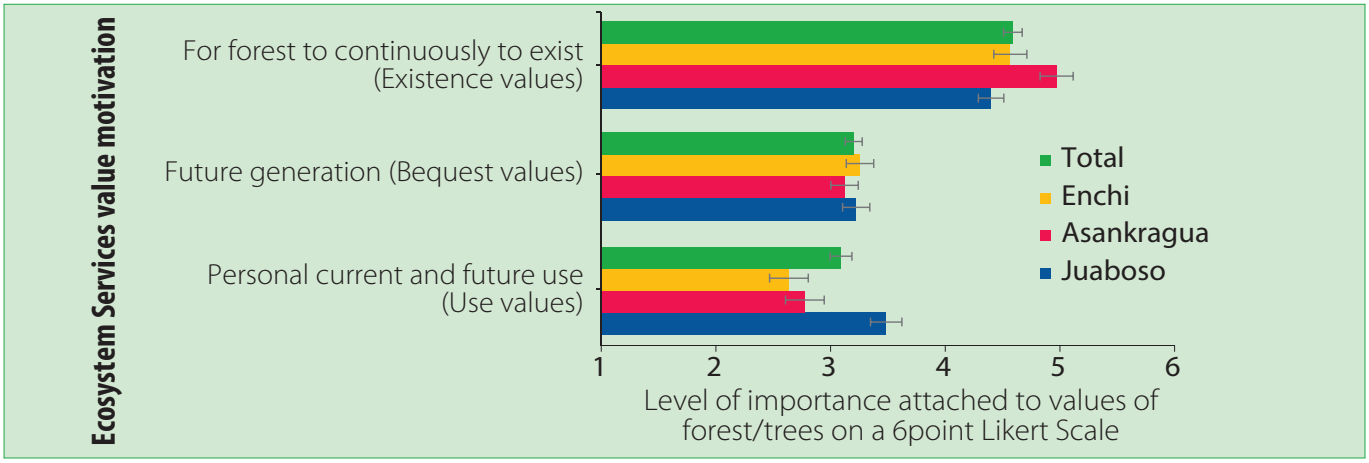

Fig 5: Respondents' ratings of their inherent value motivation for integrating trees on farms (6-point Likert scale: 1 = Not at all important, 2= not important, 3= Moderately important 4= Important, 5=Very important, 6 = Extremely important)

Direct use values are benefits from use of primary consumptive and non-consumptive ecosystem services.

Indirect use value arises from forest ecosystem services that are an input into production of goods or services that we value, e.g., soil protection, nutrient recycling and watershed protection that provides cleaner water for drinking water.

Option values are potential future uses of forest goods or services or defined as the price that individuals are willing to pay for conservation of an element in view of its possible use in the future.

Bequest values is the satisfaction or benefit people receive knowing that future generations will have access to nature's benefits

Altruistic values is the satisfaction or benefit people derived knowing that other people have access to natures benefits.

Existence value is the satisfaction people obtain from knowing an ecosystem continue to exists for various reasons other than their expected personal use. Existence value measures the value of forests as carbon sinks, and as preservers of biodiversity.

Sources: *Kengen (1997); Pearce, (2001) Hein et al., (2006); ten Brink et al., (2011); Obeng et al., (2018).*

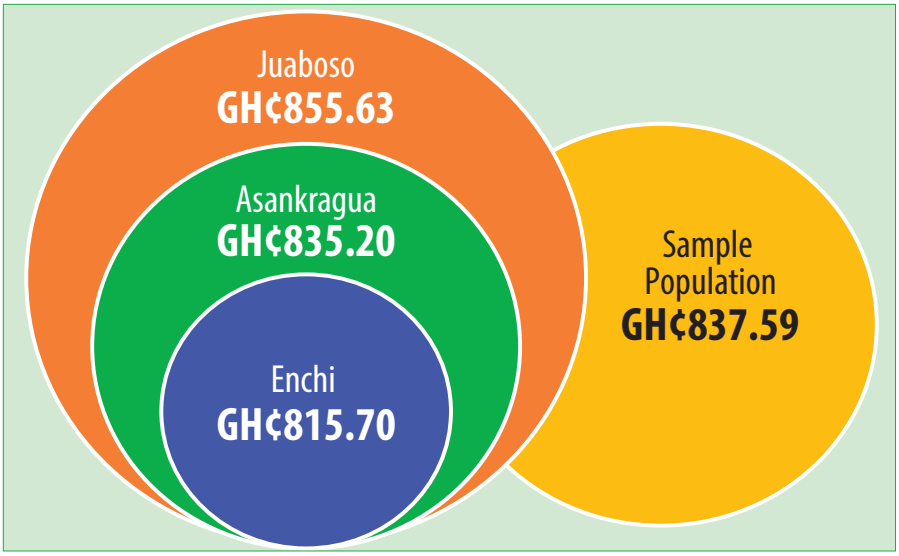

Figure 6. Estimated mean willingness to pay of farmers (economic values) for a bundle of non-market ecosystem services provided by trees on cocoa farms. (NB: Exchange rate for the Ghana Cedis (GH¢) to USD at the time of data collection was GH¢ 1.00: USD 5.10).

All mean values were higher than 3 which suggests that farmers attach more than moderate level of importance for forest ecosystem services based on different values (i.e., use values, bequest and existence values). Respondents from Asankrangwa forest district rated existence values relatively higher than respondents from Enchi, Juaboso and the overall mean (i.e., 4.97 denoting highly important). The next value motivation for keeping trees on farms was bequest values with a mean of 3.2, denoting "moderate importance". Use values (personal current and future use) was the least rated value motivation for integrating trees on farms with a mean of 3.1 denoting moderately important. With regards to the use values of forest ecosystem services, it is noticeable respondents from Juaboso forest district rated it relatively higher (3.5) than Enchi, Asankragwa and the overall mean. This means that direct benefits derived from use of primary consumptive and non-consumptive ecosystem services and option values are of more importance to them than planting trees for its existence, bequest and altruistic values.

Economic values of non-market ecosystem services provided by trees in cocoa landscapes

The value of non-market ecosystem services is not revealed in traditional market prices hence the only option for assigning monetary values to them is to rely on non-market valuation methods. Economic value of non-market ecosystem services expresses how much people would be willing to pay for these services. Cocoa farmers economic values for a bundle of five non-market ecosystem services provided by integrated trees on cocoa farms was assessed under this study. This includes trees role in providing habitat for pollinating insects – essential in cocoa cultivation nutrient cycling and soil formation, carbon sequestration, watershed management. The mean willingness to pay (WTP) based on a contingent valuation shows that farmers are willing to pay on average GH¢837.59 per hectare per household per year for five years for the specified non-market ecosystem services (Figure 6). The farmers were willing to pay for these services through donation of cocoa beans during the harvesting and buying season. Implicitly, a respondent on average would be willing to enroll in on-farm tree integration program and pay approximately GH¢837.59 per hectare per household per year for the provision of enhanced bundled non-market ecosystem services beside shade provision. Cocoa farmers in Juaboso forest district had relatively higher mean economic values for these services than those in Enchi and Asankrangwa forest

districts (Fig 6). This suggest that farmers in Juaboso place higher premium on other ecological benefits of trees on cocoa farms beyond the shade provision than those in Enchi and Asankrangua forest districts.

Overall, the estimated mean amount of willingness to pay suggests that cocoa farmers have economic values for non-market ecosystem services provided by trees on cocoa farms even though most of these ecosystem services are typically characterized as non-rivalry (the use of a service by an individual does not reduce its availability to other people) and non-excludability (once produced, people cannot be excluded from using them).

Summary

- The most important value motivation for cocoa farmers to engage in on-farm tree planting initiatives is existence values (forest protection for its continuous existence). This was followed by personal (current and future) use and bequest values (forest protection for the benefits of future generations).
- Economic values for ecosystem services reflects a relatively high level of farmers' perceptible concern value for forest. Cocoa farmers were willing to make monetary contributions to enhance non-market services derived from integrated trees on cocoa farms beyond shade. The bundle of non-market ecosystem services included tree's role in providing habitat for pollinating insects – essential in cocoa cultivation; nutrient cycling and soil formation – essential for improving soil fertility; carbon sequestration; and watershed management – water regulation).
- On average, cocoa farmers' economic values for the bundle of non-market ecosystem services supplied by on-farm trees was approximately GH₵837.59 (USD 164.00) per household per hectare per year. This is approximately 8.2% of the mean annual income of respondents and equivalent to approximately 128kg of marketable cocoa beans (2 Bags).
- Findings from this study could assist smallholder farmers, forest managers and policy makers in designing a sustainable on-farm tree initiatives that encourage ecosystem services provisions while addressing different landscape sectoral goals on yield and environmental resiliency.

References

Asare, R., 2005. Cocoa agroforests in West Africa: a look at activities on preferred trees in the farming systems. Forest and Landscape, Working Papers no.6.

De Groot, R., Brander, L., Van Der Ploeg, S., Costanza, R., Bernard, F., Braat, L., Christie, M., Crossman, N., Ghermandi, A., Hein, L. and Hussain, S., 2012. Global estimates of the value of ecosystems and their services in monetary units. *Ecosystem services, 1*(1), 50-61.

Kengen, S., 1997. Forest valuation for decision-making: lessons of experience and proposals for improvement. Food and Agricultural Organization of the United Nations, Rome

Ezebilo, E.E., 2016. Economic value of a non-market ecosystem service: an application of the travel cost method to nature recreation in Sweden. *International Journal of Biodiversity Science, Ecosystem Services & Management, 12*(4) 314-327.

Pearce, D.W., 2001. The economic value of forest ecosystems. *Ecosystem Health, 7*, 284–296.

Hein, L., van Koppen, K., de Groot, R.S., van Ierland, E.C., 2006. Spatial scales, stakeholders and the valuation of ecosystem services. *Ecological Economics,* 57, 209–228.

Ten Brink, P., Simmons, B., Furata, N., Liekens, I., Ninan, K., Meire, P., Shine, C., Tinch, R., Wielgus, J., 2011. *Recognizing the value of biodiversity: New Approaches to Policy Assessment. In:the Economics of Ecosystem and Biodiversity in National and International Policy Making,* pp 130-173. Edited by Patrick ten Brink. Earthscan, London and Washington.

Obeng, E.A., Aguilar, F.X., 2015. Marginal effects on biodiversity, carbon sequestration and nutrient cycling of transitions from tropical forests to cacao farming systems. *Agroforestry Systems,* 89, 19-35.

Obeng, E.A., Aguilar, F.X., McCann, L.M., 2018. Payments for forest ecosystem services: a look at neglected existence values, the free-rider problem and beneficiaries' willingness to pay. *International Forestry Review, 20,* 206-219.

Obiri, D.B., Bright, G.A., McDonald, M.A., Anglaaere, L.C.N., Cobbina, J., 2007. Financial analysis of shaded cocoa in Ghana. *Agroforestry Systems, 71,* 139-149.

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