ATSAF - CGIAR++ Junior Scientists Program Final Report

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Title: Comparing options for certification of jungle rubber intercropping schemes to develop management concepts in Social Forestry Programs in Central Kalimantan

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My CGIAR++ centre was ICRAF in Bogor, Indonesia. There my supervisor was Betha Lusiana. My thesis originally involved trip to Indonesia for field work which was cancelled due to the Corona pandemic.

Before its cancellation, Betha was very punctual in returning necessary forms and she was helpful contacting other organizations within Indonesia to help facilitate my trip. She also provided lots of additional information to help me prepare for the trip.

As Covid 19 spread she kept me regularly updated on the situation in Indonesia as well as current travel guidelines issued by the Indonesian government.

Following the trips cancellation it was necessary to find an alternative project I could do in lockdown in Germany. Betha was very helpful in this regard and patiently sent me many project ideas and datasets until a suitable one that fit my interests came up.

In the end, none of the datasets were sufficient to fill the requirements of a complete Master's thesis. However, with Betha and my supervisor at the university of Hohenheim Dr. Marc Cotter, it was decided I could do my thesis on the sustainability of cocoa agroforestry and use a dataset from ICRAF as an in depth case study that related to the overall topic. This worked very well in the end and incorporating the data from ICRAF as a case study elucidated many new and interesting aspects to incorporate into my thesis.

While one reference paper regarding the data was sent to me, it would have been useful if I had been sent more related literature; especially since the data set was very specific to Indonesia and finding further information was difficult.

Nonetheless I'm very grateful to Betha and her colleagues at ICRAF for all the effort they put into facilitating my JSP, especially considering that they were all dealing with the pandemic themselves at

the time. I am also grateful to ATSAF for the opportunity and aid, and would highly recommend the program.

Below are the abstract and conclusions from my thesis.

Cocoa (*Theobroma cacao* L.) production is at a crossroads: deforestation versus intensification in order to meet the growing worldwide demand. As of now cocoa has often been a driver of deforestation in many regions, with cocoa grown in plantations or agroforestry systems replacing the original forest ecosystems. But as cocoa plantations have the potential to resemble forests in terms of tree cover, such cacao agroforestry systems have gained interest as tool in tropical biodiversity conservation.

To evaluate a more sustainable way to produce cocoa, a review was carried out, looking at studies investigating the environmental, social, and economic potential of cocoa agroforestry systems in Indonesia. Initially, monocultures produce more cocoa per area of land than shaded systems. However, monocultures have lower levels of biodiversity, provide less ecosystem services and tend to have lower soil quality. Agroforestry systems are therefore often considered the better alternative, outperforming monocultural systems in crucial system services such as adaptation to climate change and carbon sequestration, as well as in total system yields. Through mimicking natural forests, these systems offer multiple benefits such as soil fertility enhancement, reduction in pest and disease pressure, erosion control, and revenue diversification, if good management practices are established. Cocoa agroforestry systems have furthermore the potential to be a catalyst for economic development if production focuses on certified beans of high quality. Additionally, 2 case studies were conducted focusing on (1) the influence of Land Status on species richness in an agroforestry system, showing that agroforests in HKm and private land both had significantly higher species richness than agroforests in national parks. And (2) the ecological compatibility of cocoa and rubber was demonstrated via a phylogenetic analysis.

Conclusions

This thesis showed a multitude of measures that can be used to upgrade cocoa farming for smallholders in Indonesia. To counteract the current trend of full sun cocoa plantation and the associated deforestation, increasing the profitability of cocoa farming by implementing a range of

good agricultural, post-harvest practices, and value chain interventions is crucial. Formerly Indonesia was mostly known for producing bulk cocoa, and while the total cocoa production is declining, Indonesia should revise its role on the global cocoa market. Concluding from the review section, cocoa AFS are especially promising, as the higher income associated with cash crops such as cocoa, offer income and employment opportunities to the rural economy (Vanwambeke et al., 2007). Thereby, farmers can generate capital for management improvements and innovations on-site. Additionally, prices for crops might be higher if grown under shade because of higher quality or price premiums from environmental certification schemes (e.g., shade grown certification). Thus, accessing green/ speciality markets via growing certified fine flavour varieties, is a highly promising strategy to increase the financial performance and reduce financial vulnerability of smallholder cocoa farmers in Indonesia (Méndez et al., 2010). Improving the legal, institutional, policy, and financial frameworks to make shade trees more profitable for smallholder cocoa farmers, alongside education programmes, are necessary steps to promote cocoa AFS in Indonesia. Similar approaches have failed in the past due to a lack of mentoring, monitoring and finical assistance. Certain social forestry programmes such as HKm's already show great potential in balancing species rich agricultural landscapes with added economic value for rural communities. To further diversify shade trees in cocoa AFS, phylogenetic analysis has shown to be a viable tool to test for compatibility. Linking plant functional traits to their evolutionary distance would be a valuable next step to provide a more precise and theory-based shade tree advice tool for agroforestry systems.

Given the evidence presented in this thesis, Indonesia finds itself at a potential turning point. The current business model of bulk cocoa has proven itself unsustainable. Cocoa AFS alongside social forestry programmes can help to initiate the transition towards sustainable produced cocoa while simultaneously increasing the conservation value of Indonesia's protected areas when implemented as buffer zones or corridors.