ATSAF - CGIAR++ Junior Scientist Program Final Report

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Country: Indonesia (remotely)
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Start and end date of stay at IARC and / or start and end date of remotely supervised project:
Title: Assessing functional diversity of old growth jungle rubber in Central Kalimantan

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As part of the junior scientist program, I was lucky enough to work with ICRAF in Bogor, Indonesia. My supervisor and point of contact there was Betha Lusiana. Originally, I would have gone to Indonesia to do field work. This was cancelled due to the covid-19 pandemic but I can recount my interactions with Betha and ICRAF while planning the field work and what transpired after.

Betha was extremely helpful towards planning the field work. Regarding formalities, she was quick to sign and send any forms and contact necessary people and

institutions within Indonesia. However, she went beyond formalities and always wrote additional information about what to expect culturally and what was expected of me.

Then, as it became clear that the covid-19 pandemic would have an impact on the field work, Betha was diligent in keeping me updated on the situation in Indonesia and how likely it was I could travel there. When a final decision was made not to go to Indonesia she was supportive and understanding even though she had done a lot of work towards that end by that point.

Following this, it was necessary to complete my thesis and the JSP with a desktop project. In order to do so, I had to find an appropriate data set that fit the requirements of my degree as well as my interests.

Alongside my supervisor Marc Cotter, Betha contacted her colleagues within ICRAF as well as the associated organization CIFOR. She then emailed me possible datasets with helpful information about them so I could make an informed decision as to their suitability. This process took some time and many data sets were too limited to fulfil the requirements of my degree. However, Betha found an expansive agroforestry dataset that was unanalysed. She told me that the original plan for the data was to come up with some sort of classification system. However, acknowledging this original idea, I was free to do with the data what I saw fit. This gave me a lot of flexibility to explore options for analyzing the data which benefited me greatly.

Given that the pandemic was probably a difficult time for Betha and ICRAF, I'm very grateful that she was still committed to finding another option for my thesis.

The one minor critique I have is that the data I eventually used was somewhat messy. There were inconsistencies with how the data was recorded, spelling mistakes, and inconsistencies in species names. The sheet with information regarding the variables could have also been clearer and more informative. However, tidying it up was manageable, just an extra work load.

Even if the original plan didn't work out, I'm very grateful to ATSAF for accepting me onto the Junior Scientist Program, and to ICRAF for their collaboration and support. I would highly recommend the program to any aspiring students with plans for a collaborative thesis abroad.

In the end I managed to develop an assessment framework for agroforests and other agroecosystems that could also be used to classify agroforests according to their functional diversity. Below is the summary from my thesis.

It is increasingly important to implement agriculture that supports livelihoods and food security while also supporting landscape scale biodiversity and the provision of multiple ecosystem services. Such agroecological systems are deemed

multifunctional. Agroforestry is a practice with great potential for multifunctionality but requires appropriate implementation and management to achieve such an end. Multifunctionality in a given system hinges on the cultivation of multiple species that are complementary to each other according to the principles of niche complementarity. The dissimilarity in niche space occupied by complementary species, reflected by distinct functional trait syndromes, may allow for more efficient resource utilization, reduced competition and the provision of a wider array of ecosystem services. Therefore, to assess and implement multifunctional agriculture, tools that elucidate niche complementarity via a species' functional traits in measures of functional diversity need to be developed. To that end, this thesis aimed to review the literature on methodological tools for assessing functional diversity and associated niche complementarity, including methods for elucidating which species from a given pool may be complementary to each other, as well as synthesize appropriate tools into an evaluation framework.

The evaluation framework developed incorporates synergistic methods in a four-step process. The steps include: evaluation/re-evaluation of functional diversity as the first and third steps, the identification of complementary functional groups from a given species pool that can then be inventoried and used to inform subsequent management interventions as the second step, and fourth is an evaluation of alpha and beta functional diversity for stakeholders who wish to implement a landscape scale assessment.

This framework was then tested with on-site data on agroforests in Indonesia. The framework was able to highlight sites with low functional diversity that likely have low multifunctionality as well as those with high functional diversity that could subsequently be used as model systems for multifunctionality. Additionally, the framework enabled the identification of specific management interventions to improve an agroforest's functional diversity. The functional groups identified in step 2 enable stakeholders to select complementary species to those already cultivated in order to improve the functional diversity and multifunctionality of a given agroforest.

With a growing importance placed on biodiversity and ecosystem services within agroecosystems, particularly from political and economic sectors, it is crucial to have methods that can simply and reliably assess their ability to provide ecosystem services as well as indicate ways of improving their provision. The relative ease of this framework's implementation, as compared to alternatives discussed in this thesis, makes it promising for broad-scale rapid assessment of agroforests and other agroecosystems.