# Seed Collection for Restoration and Increased Biodiversity Efforts at Finca Las Piedras

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## Abstract

Western Amazonian forests in Madre de Dios, Peru, are one of the highest biodiversityregions on earth and provide important ecosystem services like carbon sequestration, nutrient cycling, water conservation, and overall an important means of climate change mitigation (Lawrence, A., Phillips, O.L., Ismodes, A.R. et al., 2005). In developing countries like Peru, however, forest resources in the tropics have declined rapidly over the past years due to defor- estation (Nicolau et al. 2019). Illegal gold mining and logging, clearing land for agriculture and cattle grazing, and timber extraction has grown significantly in the Amazon and has driven land degradation and loss of rainforest area (Román-Dan obeytia, 2015). Therefore, many countries have started reforestation projects to mitigate these impacts. This study is a continuation of a project started on June 13, 2022 by two past Alliance for a Sustainable Amazon interns, Linnea Barrett and Regina Ortiz, in which they collected seeds and fruits at Finca Las Piedras in hopes of contributing to forest restoration efforts at FLP. I followed their methodology and found 21 different species of seeds/fruits and collected 171 seeds/fruits in total. Of the 21 species, three of them were useful for the project which included 113 seeds, eight species were unknown, and the rest were decomposed, partially decomposed, or not ripe.

## Introduction

Deforestation has increased over the past decade in the Madre de Dios region in Peru due to illegal gold mining, slash and burn agriculture, and timber extraction to name a few (Román-Dan obeytia, 2015). Because of this, many countries in the tropics have started reforestation efforts to mitigate deforestation impacts including reduced carbon sequestration, negative effects on rural income and the economy, land degradation, and loss of rainforest area (Le, 2012). Reforestation is the process by which trees are returned to areas that have been previously cleared out (Le, 2012). As a result of increasing rates of deforestation in the Madre de Dios region, the importance of reforestation in mitigating some of the impacts of deforestation is paramount, in addition to providing the ecosystem services that might have been lost. Anthropogenic reforestation can assist in creating environmental heterogeneity, which has known benefits for supporting high biodiversity, rather than allowing secondary succession to occur naturally, as this may result in the dominance of a singular or invasive species. Western Amazonian forests in Madre de Dios, Peru are one of the highest biodiversity regions on Earth (Lawrence, A., Phillips, O.L., Ismodes, A.R. et al., 2005). This project aims to conserve and restore this biodiversity in degrad-

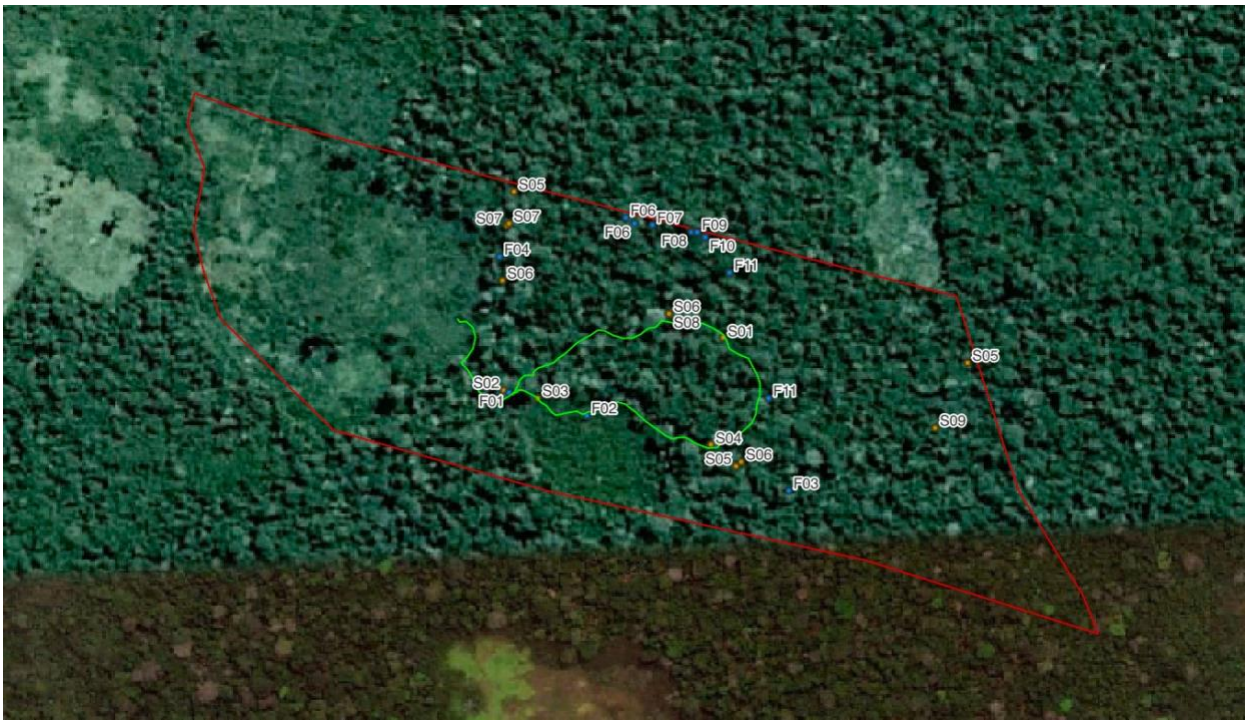


*Figure 1. Locations of the collected seeds and fruits. They are labeled by number in order of when I found them accompanied with an S or F for seed or fruit. The green line is the castana trail and the red line is an outline of the Finca Las Piedras property.*

ed or cleared forests, specifically at Finca Las Piedras. My goal is to support a resurgence of native species and provide aid in creating environmental heterogeneity in regenerating forests. I did this by collecting, identifying, and plating seeds I found in the rainforest area of FLP. Once the trees are large enough, interns or naturalists at FLP will move them from the shade house and plant them in the ground. I followed the methodology created by two previous Alliance for a Sustainable Amazon interns and added on to their spreadsheet to build a database for ASA.

**Methodology & Protocol**

Two previous ASA interns, Linnea Barrett and Regina Ortiz, started this project in June of 2022 and created this methodology wtith the goal that it could be replicated for future use. After finding seeds/fruits in the forest, I followed their protocol which included recording the collection date, number of seeds/fruits found, identifier of seed/fruit species, when identified, identifying information, plant local and latin name, the coordinates where it was found, and seed/fruit placement. If I could find what tree the seed/fruit fell from, I recorded a description of the tree, diameter breast height of tree, and additional orienting information. In addition to these recordings, I took pictures of both the seed/fruit, the inside and outside, and the tree — the bark, roots, leaves, anything identifiable. I labeled each of the seeds/fruits in order of collection — 01 to 12 — along with either an F for fruit or S for seed (Fig. 1). After returning to the lab at FLP, I input ed all this information into the spreadsheet "Fruit and Seed Collection_FLP_Webber" that is an extension of the spreadsheet Bar-

rett and Ortiz started. I stored each species in a plastic container with the lids off so that they had adequate aeration to avoid molding. Lastly, I looked through the Semillas/Frutos de Cocha Cashu field guide by the "Estacion Biologica Cocha Cashu, Parque Nacional MANU, Madre de Dios, Peru, to identify what I collected. If I could not find the seed or fruit in this guide, I asked Lead Naturalist Jose Cueva Santos.

**Results**

I found 21 different seed/fruit species and collected 171 seeds/fruits in total. Of the 21 species, three of them were useful for the reforestation project, which included 113 seeds total. I planted all 113 seeds: 40 *Hymenaea oblongifolia*, common name of Azucar Huayo, 49 *Euterpe precatoria*, common name of Huasai Palm, and 24 *Iriartea deltoid*, common name of Pona. The other species I collected but were not viable for the project are *Apeiba tibourbou, Dugetia Spixiana, Apeiba membranacea, Oenocarpus bataua*, and *Calatola costaricensis*. These were not viable because they were decomposed, partially decomposed, or not ripe. Combined, there were 37 unviable seeds/fruits. Lastly, there were eight unknown species; 21 seeds total.

**Discussion**

Due to accelerated deforestation, it is clear reforestation efforts are necessary. By planting overlooked or rare seeds, this project contributes to long term reforestation efforts at Finca Las Piedras. The methodology Barrett and Ortiz created indeed succeeded in their goal of replication to continue this project time and time again, "making this method of reforestation a necessary piece of the framework here at Finca Las Piedras" (Barrett and Ortiz, 2022). However, I encountered some difficulties while completing my research and have come up with suggestions on how to improve and build on the project. One suggestion for future researchers/interns wanting to continue this project or personally for a side project is to look at the field guide before hand or have the field guide with you, preferably on your phone, while looking for seeds/fruits. For someone who knows nothing about seeds and fruits in this region, I didn't know the difference between decomposed and viable seeds looked like for different species. Due to this, I would bring back a seed or fruit I thought was good but ended up being decomposed. Having the field guide on you would be helpful to refer to after finding a seed/fruit in the rainforest so if you find out it's not ready or decomposed, you don't have to collect it and waste the energy of going through the protocol. Another suggestion is to try and open up the prospected seed/fruit while on the trail or back at FLP, because some fruits I found, I originally thought were seeds, and therefore couldn't find the species on the field guide since I was looking at the seed section, not fruit. Once I tried to crack it open and found seeds inside, I could identify it as a fruit, or a seed if the opposite was true. This is helpful for identification but also for your data, so you're not falsely documenting things in your reforestation efforts. It's important to note that most fruits or seeds I found had a tiny hole in them where ants have eaten the insides. This is another reason it would be beneficial to try and open the fruit on the trail so you won't bring back a dead fruit/ seed if the insides are eaten from ants or termites. Lastly, to build on this project or even to start a new project, I believe a FLP

Semillas and Frutos field guide should be made. To identify seeds, I had to refer to the field guide of Cocha Cashu. Although Cocha Cashu is also in the Madre de Dios region, with 12% of the species I found being unknown by Jose and not on the field guide, it would be helpful and educational to make one specifically for FLP. Despite these slight setbacks, the overall project was successful with 69% of the seeds I found viable for reforestation efforts.

**Acknowledgments**

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**Citations**

Andrea Puzzi Nicolau et al 2019 Environ. Res. Lett. 14 124045

Hai Dinh Le, Carl Smith, John Herbohn, Stephen Harrison (2012). More than just trees: Assessing reforestation success in tropical developing countries. Journal of Rural Studies 28, 5– 19

Francisco Román-Dan obeytia et al. (2015). Reforestation with four native tree species after abandoned gold mining in the Peruvian Amazon. Ecological Engineering 85, 39–46

Lawrence, A., Phillips, O.L., Ismodes, A.R. et al. Local values for harvested forest plants in Madre de Dios, Peru: Towards a more contextualised interpretation of quantitative ethnobotanical data. Biodivers Conserv 14, 45–79 (2005). https://doi.org/10.1007/s10531-005-4050-8