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

Zoe Jenkins

Corresponding emails: zoejenkins@ucsb.edu & info@sustainableamazon.org

Abstract

With about 10 million hectares of rainforest designated for human presence and restricted economic uses,the Peruvian Amazon is at a high risk. Agroforestry, a practice involving diverse planting of trees and crops, offers various benefits over monoculture agriculture, such as improved soil health, disease control, climate regulation, and sustainable economic models. Reforestation, the planting of native species in degraded lands, also holds promise for restoring biodiversity and supporting ecosystem services. This study was conducted at the Alliance for a Sustainable Amazon (ASA) research station in Madre de Dios, Peru, during the dry season. Trails within the primary forest were surveyed to identify and collect fruits from native trees that ripen during this season. The collected seeds were then planted to be used for agroforestry and reforestation efforts. The collection produced 20 fruit species and 217 individuals, with 110 seeds suitable for planting. Notably, the study underscores the significance of rain in fruit production, highlighting the impact of reduced rainfall on seed availability and forest regeneration. The findings contribute to ongoing efforts to enhance local biodiversity through agroforestry and reforestation, emphasizing the importance of a comprehensive field guide for accurate plant identification in the region. This research underscores the potential of agroforestry and reforestation in fostering sustainable practices and preserving the unique biodiversity of the Peruvian Amazon.

Introduction

Of the over 18 million hectares of rainforest Peru has placed under protection, 55.3% allows human presence and restricted economic uses (Dourojeanni, 2015). The allowance of this direct-use of the rainforest leaves much of the Peruvian Amazon vulnerable and degraded as it is shown that deforestation is much greater in these areas compared to fully protected areas like national parks (Dourojeanni, 2015). This results in the removal of native species and a dramatic loss of biodiversity. One way to reintroduce native species and improve local biodiversity in degraded forests is to implement agroforestry in areas of degraded farmland, or changing monoculture to agroforestry. In agroforestry a farmer can plant trees to harvest their fruits year after year. In comparison to monoculture agriculture, there are many benefits to doing diverse agroforestry. In Finca las Piedras, where this study will take place, there is a plot that has rows of copoazu interspersed with rows of Inga edulis a technique known as alley cropping which is a fast-growing native in the bean family that enriches the soil while shading out invasive African cattle grass and other weeds (ASA), highlighting how diverse crops improve the soil compared to the typical monoculture. Local plants also have the advantage of a shared evolutionary history with their environment. For

example, farmers in Peru were shown to prefer local cacoa species over industrialized ones because of their resistance to pests, high market potential and cultural value, as well as taste even though they grow less productively in relation to fruit production (Laneaux et al., 2021). Other benefits include disease control, climate regulation (Mortimer et al., 2017), reduced chemical inputs, increased productivity in the long-term and perhaps most importantly, if managed properly, an agroforestry-based economy can help break the stubborn cycle of deforestation in the Amazon (ASA). Another option for increasing native species abundance and biodiversity is through reforestation (Derh et al. 2016). This entails planting native plants and trees to restore the biodiversity of land that had been cleared and degraded through intensive agricultural practices. Seed dispersal also increases when reforestation takes place (Derh et al. 2016) which creates a feedback loop where reforestation leads to an increase of plant abundance and diversity and, as mentioned before, native plants can help enrich with climate regulation (Mortimer et al., 2017). In order to help with local agroforestry and reforestation efforts at the Alliance for a Sustainable Amazon research station, trails throughout the primary forest were repeatedly walked throughout the months of July and August, identifying, marking, and collecting fruits from fruiting trees. The aim of this project was to record and identify what species of native plants produce fruit that ripens during the dry season, which runs roughly from May to September in Madre de Dios with an average rainfall of about 52mm per month. Once fruits were identified, the seeds were planted in ASAs tree nursery to be used in future reforestation efforts. This study will also provide a catalog of what fruits will ripen through the dry season, which will hopefully benefit local agroforestry diversity.

Site Description

Research was done on the 45ha plot of primary forest owned by the Alliance for a Sustainable Amazon research station (ASA) at Finca las Piedras, in the department of Madre de Dios in southeastern Peru. Madre de Dios is located in the western Amazon, regarded as the most biodiverse place on Earth (Finer et al., 2015). This study took place in late July and early August, the dry season in this area. July and August usually have about 57mm and 64mm of rain, respectively. ASA has areas of active reforestation and experimental agroforestry. These areas are not included in the study in order to gather fruits that were not easily available, as the aim was to increase diversity of collected species.

Methods

For collection, all of the marked trails in ASAs primary forest were walked while scanning the ground and trees around eye level to find seeds or fruits. Each time a fruit was encountered it was investigated to see if it was rotten, moldy, or partially consumed. If the seed would not be eligible to plant, it would not be collected or recorded. When an eligible fruit was found, a photo would be taken and it would be marked on GPS with a tag number so it could be later recorded and mapped. The fruits size, shape, color, number of seeds and other relevant information was noted. The tree where the fruit came from would be searched for and, if found, a picture would be taken of it, and notes describing the shape of the tree, the color of the bark along with any other relevant information to be used for identification. Back at camp the seeds found were cataloged in the excel

Figure 1: Locations of the collected fruits. They are labelled by number in order of when found. Red line is Castana Trail and Yellow line is Finca Property

spreadsheet started in June 2022 by Barrett and Ortiz. The seeds were kept in a dry, open container until planted. They were planted as soon as possible to prevent mold from growing and damaging the seeds. Field guides and Barrett and Ortizs photos were used to identify the seeds found. The latin name and, if applicable, the local name of each plant identified was put into the spreadsheet. Small potting bags were used for planting with one seed in each. The exception to this was when there were hundreds of tiny seeds packed into a fruit. If the fruit with a lot of seeds was large, a section of the fruit was removed and planted in one bag. If it was a small fruit, the whole fruit was planted. The planted seeds were kept in the vivero under shade. The naturalist team watered the plants every day.

Results

Twenty different fruit species were found during collections. This included 217 individuals. As a result of natural decomposition or consumption that had not been noted during initial collection, many seeds were not suitable to be planted, therefore 110 out of the 217 seeds collected were able to be planted for agroforestry or reforestation efforts at ASA. Of the 110 planted, 31 seeds were F02, or Geonoma mactostachys arecaceae, a small palm. The second most abundant was F18, an unknown species, at 18 planted seeds. The third most abundant in my planting was F01, Huasai Palm, at 16 planted seeds. A total of 6 seeds were already germinated when planted, 5 of which were Huasai Palms and 1 was F03, which remains unidentified. 60 percent of all fruits found just had one seed, only 4 had more than 2 seeds and most fruits were small at 1 to 2 centimeters long. The seed dispersal was fairly even throughout the property as seen in Figure 1.

Discussion

Reforestation is important in any degraded forest but is especially important

in places like ASA which is surrounded by agricultural lands. This study was a continuation of two studies done during the dry season in 2022, very little is known about fruits in this area so this will add to the dataset started by Barret and Ortiz. The seeds planted will add biodiversity to the secondary forest and insure that the plants are native to this region. Comparing this study to the ones last year show several differences and similarities. All three studies found a significant amount of seeds from the Huasai Palm (acai) and all three documented the Pona Palm. This study found many Geonoma macrostachys, a small palm tree, but last summer none were found at all. All three studies found similar amounts of species but very different individual counts. Barret and Ortiz were able to collect a staggering 558 seeds in just one week in June 2022. I collected 217 seeds with a collection period of about three weeks in July and the beginning of August 2023. I hypothesized that this was due to the unusual lack of rain this season. I found a significant difference in rainfall between the two years. The average rainfall of June and July 2022 was 38mm, the average of the same months in 2023 was just 12.5mm. The average rainfall for Madre de Dios in these months is typically 58.77mm. I think this decline in rainfall affected the quantity of fruits and seeds found. If true, this is very significant since the natural formation of light gaps is so frequent (Forsyth, Miyata 2011). The forest is constantly renewing itself. So, if there are less seeds being dispersed, the forest will take longer to regenerate. Fruits and seeds are also a very important food source for many rainforest animals. As mentioned by Webber (2022) a field guide for fruits and seeds for Finca las Piedras is needed. The most relevant guide is from Cocha Cashu, which is in Madre de Dios but is far enough away to include many species that are not in this region. The lack of available information on fruits in the Amazon led to most of my seeds remaining unidentified.

Works Cited

Derh , Mia A., et al. Measuring the success of reforestation for restoring biodiversity and ecosystem functioning. Journal of Applied Ecology, vol. 53, no. 6, 2016, pp. 17141724, https://doi.org/10.1111/1365-2664.12728.

Dourojeanni, M.J., 2015. Human impact on protected areas of the Peruvian Amazon. Protecting the wild: Parks and wilderness, the foundation for conservation, pp.215-225.

Finer, Matt, et al. Future of oil and gas development in the western amazon. Environmental Research Letters, vol. 10, no. 2, 2015, p. 024003, https://doi.org/10.1088/1748-9326/10/2/024003.

Forsyth, Adrian, and Miyata, Ken. Tropical Nature: Life and Death in the Rain Forests of Central and. United Kingdom, Touchstone, 2011.

Lagneaux, E., Andreotti, F. and Neher, C.M., 2021. Cacao, copoaz and macambo: Exploring Theobroma diversity in smallholder agroforestry systems of the Peruvian Amazon. Agroforestry Systems, pp.1-10.

Madre de Dios, Peru Climate. Madre de Dios, PE Climate Zone, Monthly Weather Averages and Historical Data, 2023, tcktcktck.org/peru/madre-de-dios#:~:text=Madre%20de%20Dios%20Climate%20Summary&text=The%20citys%20yearly%20temperature%20is,%25%20of%20the%20time)%20annually.

Mortimer, R., Saj, S. and David, C., 2018. Supporting and regulating ecosystem services in cacao agroforestry systems. Agroforestry Systems, 92(6), pp.1639-1657.

Parrado Rosselli, A., Machado, J.L. and Prieto L pez, T., 2006. Comparison Between Two Methods for Measuring Fruit Production in a Tropical Forest 1. Biotropica: The Journal of Biology and Conservation, 38(2), pp.267-271.

Reyes, J. (2021) Reforestation. Available at: https://www.sustainableamazon.org/research (Accessed: 1 July 2023).