

Report Draft

**RAPID ASSESSMENT OF FLORA SPECIES
REGENERATION IN FORESTRY PLANTATIONS**

Presented to

FUTURO FORESTAL

By

**ASOCIACIÓN NACIONAL PARA LA CONSERVACIÓN DE LA
NATURALEZA – ANCON**



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1. INTRODUCTION

The traditional development of forestry plantations in the tropics has been the promoter of the establishment of desirable species and the periodic elimination of “weeds” that could affect the growth of the plantation.

This model has been very successful economically, but is not considered friendly with the environment and can eventually deplete the soil where the plantations are, which is negative for a commercial activity that is dependent on soil. Although any edaphic condition can be corrected with the use of agrochemicals, this can cause long-term undesirable side effects, often in the areas surrounding the plantations; adding the fact that forest utilisation occurs decades after the activity has started.

Fortunately, new tendencies have emerged that focus on harmonising commercial forestry activity with environmental sustainability, which is also commercial sustainability. One possibility, perhaps the most progressive, are generational forests, advocated as the best option to attain sustainable forest harvests with the least environmental impact.

Even though it is innovative and attractive as a concept, in practice it requires more dissemination among those involved in forestry activities, especially those who do the field work, sowing and maintaining the plantations.

Nevertheless, the main thing is that as a concept and a forestry activity, what lies at the center is the idea of managing forests for all successive generations to benefit from its products. We still have to tear down traditional thoughts, unlearn what was not producing good results and incorporate these new tendencies in forestry.

In this report we evaluate the first steps that are being implemented with the concept of generational forests in different geographical and cultural realities in Panama.

1.1 BACKGROUND

Since a few years ago, the company Futuro Forestal has been working with an innovative concept in forestry activity: generational forests. This way of conducting commercial forestry proposes managing plantations and natural forests in a sustainable fashion, so that up to seven generations can benefit from them after the first harvest. With the development of sustainable utilisation, from the second generation onwards, one gets a glimpse that forest use and benefits will be truly continuous and permanent if the concept of generational forests is maintained to manage plantations.

1.2 RATIONALE

Generational forests require much information that has not yet been gathered to make the necessary adjustments in order that will ensure compliance in long-term sustainable utilisation. This proposal presents the methodology needed to complete some of the aspects of natural regeneration in forests and plantations.

This information will become part of the baseline of knowledge that will be gathered to clarify concepts and processes that achieve success in the application of generational forests.

2. OBJECTIVES

2.1 GENERAL

- Get to know the natural regeneration of flora species and some of their potential pollinators and seed dispersers in the established plots in reforested farms, managed under the reforestation concept of “Generational Forests”.

2.2 SPECIFIC

- Conduct a un census of the regeneration flora species found in the project’s reforestation farms, under the concept of “Generational Forests”
- Identify some of the main pollinators and seed or fruit dispersers of species of forestry importance in reforested farms, managed under the concept of “Generational Forests”
- Generate a database with the information gathered in field activities developed for this project.
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3. AREA STUDIED

Below we describe the physical and climatic characteristics of the sites where the project farms are found, including information from the National Atlas of the Republic of Panama (IGNTG, 2007), the Geological Map of the Republic of Panama (MICI, 1991) and the website of the Electric Transmission Company - Empresa de Transmisión Eléctrica, S.A. (ETESA, 2015).

3.1 LOCATION

The area of the project’s implementation comprises four sites distributed in the entire republic (Table 1, figure 1).

TABLE 1. FARMS VISITED DURING THE PROJECT

Site	Province	Farm	Ha
La Mesa	Veraguas	Carlos Castillo	15,0

		La Torcaza	200,0
		Agustín Mendoza	30,0
		Carrera	40,0
		Los Ríos	5,8
Las Lajas	Chiriquí	Concordia	8,0
		Madera Fina	1,0
		Silimín	10,0
Santa Rita	Colón	Santa Rita	360,0
		Palmas Bellas	560,0
Palmas Bellas	Darién	Reina	25,4
		Kapok	54,6



Source: Futuro Forestal, S.A.

Figure 1. Location of the sites included in this work.

These sites present different topographic, climatic and management conditions. Even though we don't have the site plans, Futuro Forestal provided the farm polygons superimposed on Google Earth images (except for the Palmas Bellas farm), which allowed us to locate the farms, their accesses, their form and predominant vegetation (Annex 1). With the existing data that appear in these images, the polygon coordinates where the visited farms are located were found (Table 2) — except for La Mesa, where the locations of both groups of farms are more than 30 km apart (in a straight line).

TABLE 2. LOCATION COORDINATES OF THE WORK SITES

Site	UTM Coordinates*			
	North	South	East	West
La Mesa, Veraguas	912736	909302	463126	461505
	894015	893433	486250	485509
Las Lajas, Chiriquí	916265	907324	404815	399332
Santa Rita, Colón	1036614	1034323	639272	639097
Palmas Bellas, Darién	979177	973854	805642	799727

Source: Futuro Forestal, 2015. Caption: * Universal Transverse Mercator

Even though the Las Lajas farms are also in two groups, the farm in San Félix area is less than 5 km away from the ones in the Las Lajas area.

3.2 PHYSICAL CHARACTERISTICS

The physical characteristics of the site are very varied and are not yet homogeneous in one site, so they are presented in two sections: the first groups the characteristics that are relative to the relief and the second, groups those relative to the climatic aspects.

3.2.1 EDAPHIC AND OROGRAPHIC

Table 3 summarises the characteristics relative to the soil and the relief of the four work sites. Two of them are subdivided due to the distance between the farms, particularly in La Mesa, where the farm is located in Rincón Largo - about 30 km away in a straight line from the farms located in the region of San Bartolo. They present some differences in the parameters described in the table.

This difference also occurs in Las Lajas, although the distance between the groups of farms is only 5 km, there are still differences between the region of Las Lajas and San Félix.

The other sites did not present these differences, but the farms were grouped around the Palmas Bellas farm — even though the Palmas Bellas site was the largest (it represents almost 50% of the total project surface area).

TABLE 3. EDAPHIC AND OROGRAPHIC CHARACTERISTICS OF THE WORK SITES

SITE		RELIEF	SOILS	HYDROLOGY
La Mesa	<i>Rincón Largo</i>	Hills and low mountains, with some flat zones	Inceptisols-Alfisolos and Ultisols	Basin 118, San Pablo River
	<i>San Bartolo</i>	Hills and foothills of the Central Mountain Range	Ultisols and Alfisolos	Basin 120, San Pedro River
Las Lajas	<i>Las Lajas</i>	Flat, typical of coastal floodplains.	Ultisols and Alfisolos	Basin 110, rivers between Fonseca and Tabasará
	<i>San Félix</i>	Foothill hills	Inceptisols-Alfisolos and Ultisols	
Santa Rita		Steep terrain, hills and low mountains	Inceptisols-Alfisolos and Ultisols	Basin 115, Chagres River
Palmas Bellas		Undulated, soft hills and some flat portions	Entisols	Basin 152, Sabana River and between Chucunaque

Source: ETESA, 2015; IGNTG, 2007

3.2.2 CLIMATIC

Climatic data for the work sites reflect the variability in rainfall, annual evaporation and relative humidity (Table 4). Although the data on Palmas Bellas, obtained in the Tortí station, has the lowest rainfall of all four sites, it has the second highest relative humidity and the lowest annual evaporation.

TABLE 4. PHYSICAL CLIMATIC CHARACTERISTICS OF WORK SITES

SITE		CLIMATE (MACKAY)	RAINFALL (mm)	AVERAGE ANNUAL TEMPERATURE (° C)	RELATIVE HUMIDITY (%)	ANNUAL EVAPORATION (mm)
La Mesa	<i>Rincón Largo</i>	Sub-equatorial with dry seasons	2.700	26,4	77,2	1.804
	<i>San Bartolo</i>		2.823		79	1651
Las Lajas	<i>Las Lajas</i>	Sub-equatorial with dry seasons	3.504	26,7	83,7	1.275
	<i>San Félix</i>		4.039			
Santa Rita		Tropical oceanic with a short dry season	3.711	25,6	87.5	No records
Palmas Bellas		Tropical with a long dry season	1.910	26,4	87,4	1.091

Source: ETESA, 2015;

In the available data, the amount of rainfall recorded in Torti stands out, as it is at least 1.5 times less than the average rainfall of La Mesa, which is the next place with the lowest annual rainfall. On the other hand, temperature is always higher at the site closest to the sea, even though the difference between the warmest and coolest sites is less than two degrees centigrade.

3.3 BIOTIC CHARACTERISTICS

Compared with the physical characteristics of the work sites, the biotic characteristics are more uniform, given that there is only a slight variation between the sites where there is a theoretical border between life or vegetation zones (Las Lajas).

BOX 5. BIOTIC CHARACTERISTICS OF WORK SITES				
SITE	LIFE ZONES	ECO-REGIONS	VEGETATION	
La Mesa	<i>Rincón Largo</i>	Tropical humid forest	Humid forests on the Pacific side of the Isthmus of Panama	Production system with significant natural or spontaneous woody vegetation (< 10%)
	<i>San Bartolo</i>			Production system with significant natural or spontaneous woody vegetation (10 - 50%)
Las Lajas	<i>Las Lajas</i>	Very humid pre-montane tropical forest	Humid forests on the Pacific side of the Isthmus of Panama	Production system with significant natural or spontaneous woody vegetation (< 10%)
	<i>San Félix</i>	Very humid tropical forest		Production system with significant natural or spontaneous woody vegetation (10 - 50%)
Santa Rita	Very humid tropical forest	Humid Forests of the Atlantic side of Central America		Evergreen Tropical Rainforest – very intervened
Palmas Bellas	Humid tropical forest	Humid forests of the Chocó/Darién		Production system with significant natural or spontaneous woody vegetation (10 - 50%)

Source: ETESA, 2015; IGNTG, 2007

The predominant types of vegetation or land use in the project sites are those of least vegetation cover that are traditionally known as pastureland, heavy brush, or subsistence farming areas.

3.4 PLOT SURROUNDINGS AND OBSERVATION POINTS

Although the plots are within forestry plantations and they share most planted species, they each have slightly different surroundings and they develop on land with different soil uses or forest cover, as shown in table 6. And even though most plots were established in places that used to be cattle pastures or had heavy brush, some of them are located on sites that had secondary forest cover.

On the other hand, because the plots measure 1.000 m² (31,62 x 31,62 m) and have been selected to be monitored, they are surrounded by forest covers that may be extensions of the plantation to which the plot belongs, other types of plantations, land used as cattle pasture, or secondary forest.

Regarding the species used in the plots, there are various types of plantations: a combination of mixed forest and ecological natives species, mixed native species plantations, monocultures of native species, and plantations of exotic species. Based on these combinations, the differentiating factor among many of the plots was the planting season.

TABLE 6. CHARACTERISTICS OF THE PLOT SURROUNDINGS AND OBSERVATION POINTS

Sites and Farm	Plot N°	Type	Year of Planting	Surrounding Communities	Origin
<i>La Mesa</i>					
Manuel Castillo	1	Mixed	2013	Pastureland, plantation	Pastureland
Manuel Castillo	2	Mixed	2013	Plantation, secondary forest	Pastureland
Manuel Castillo	3	Pastureland	...	Pastureland, plantation	Pastureland
La Torcaza	4	Mixed	2013	Pastureland, plantation	Pastureland
Agustín Mendoza	5	Mixed	2013	Pastureland, plantation	Pastureland
La Torcaza	6	Pastureland	...	Pastureland, secondary forest	Pastureland
<i>Las Lajas</i>					
Carrera	1	Mixed	2011	Pastureland, plantation, mangrove	Pastureland
Carrera	2	Mixed	2011	Heavy brush, Plantations	Pastureland
Carrera	3	Pastureland	2011	Pastureland, heavy brush, plantation	Pastureland
Los Ríos	4	Zapatero	2000	Pastureland, plantation	Pastureland
Los Ríos	5	Teak	1999	Plantation	Pastureland
Los Ríos	6	Yellow Cedar	1999	Plantation, secondary forest	Pastureland
Madera Fina	7	Yellow Cedar	1994	Pastureland, plantation	Pastureland
Concordia	8	Mixed	2011	Pastureland, plantation	Pastureland
Silimín	9	Mixed	2011	Pastureland, heavy brush	Pastureland
<i>Santa Rita</i>					
Santa Rita	1	Yellow Cedar	2014	Plantation, secondary forest	Heavy brush
Santa Rita	2	Mahogany	2014	Plantation, secondary forest	Secondary Forest
Santa Rita	3	Cocobolo Rosewood	2014	Pastureland, plantation	Heavy brush

Santa Rita	4	Níspero	2010	Plantation	Heavy brush
Santa Rita	5	Zapatero	2011	Plantation	Heavy brush
Santa Rita	6	OP	2014	Plantation, secondary forest	Secondary Forest
<i>Palmas Bellas</i>					
Palmas Bellas	1	Teak 2008	2008	Plantation	Pastureland
Palmas Bellas	2	Teak 2012	2012	Plantation, secondary forest	Heavy brush
Palmas Bellas	3	Teak 2010	2010	Plantation	Pastureland
Palmas Bellas	4	Teak 2011	2011	Plantation	Heavy brush
Palmas Bellas	5	Teak 2013	2013	Plantation	Pastureland
Reina	6	Teak	2013	Plantation	Pastureland
Kapok	7	Yellow Cedar	2008	Plantation	Pastureland
Kapok	8	Almendro	2008	Plantation	Pastureland
Kapok	9	Teak	2008	Plantation	Pastureland
Kapok	10	Cocobolo Rosewood	2008	Plantation	Pastureland
Kapok	11	Spiny Cedar	2008	Plantation	Pastureland
Palmas Bellas	12	OP	...	Secondary Forest	Secondary Forest

Source: Field data 2015

4. METHODOLOGY

For the biological component, the efforts were focused on two aspects: existing flora, and pollinating and dispersing flora. The methodology for this research is described below.

4.1 VEGETATION IN THE PLOTS AND OBSERVATION POINTS

Although it was not one of the objectives of the project, it was necessary to briefly describe the plot surroundings, in order to differentiate and analyse the flora and fauna found in the visited plots.

The description only highlights the type of plantation the plot has, the vegetation, land-use strategy implemented to establish it, the natural or forestry units that surround it and some dominant species by strata, if any.

4.2 FLORA

Most of the flora analysis took place in the monitoring plots that have already been established on different farms. Only pastureland plots and additional observation points were analysed outside of the monitoring plots. Table 7 describes the relationship between the farms, plots and observation points.

TABLE 7. PLOTS AND OBSERVATION POINTS BY FARM VISITED DURING THE PROJECT

Site	Province	Farm	Plots				Observation Points			
			Total	Pl	Bq	Pt	Total	Pl	Bq	Pt
La Mesa	Veraguas	Carlos Castillo	3	2	-	1	3	2	-	1
		La Torcaza	2	1	-	1	2	1	-	1
		Agustín Mendoza	1	1	-	-	1	1	-	-
		Carrera	3	2	-	1	3	2	-	1
Las Lajas	Chiriquí	Los Ríos	3	3	-	-	3	3	-	-
		Concordia	1	1	-	-	1	1	-	-
		Madera Fina	1	1	-	-	1	1	-	-
		Silimín	1	1	-	-	1	1	-	-
Santa Rita	Colón	Santa Rita	5	5	-	-	6	6	-	-
		Palmas Bellas	5	5	-	-	6	5	1	-
Palmas Bellas	Darién	Reina	1	1	-	-	1	1	-	-
		Kapok	5	5	-	-	5	5	-	-
Total		12	31	28	0	3	33	29	1	3

Source: Field Data 2015. Key: Pl: Plantation Bq: Forest Pt: Pastureland

In each farm, the plots were located according to different plantation arrangements, creating only one plot per species arrangement and year, when there were differences in the establishment period of the plantations (Table 8), avoiding records of plots in plantation polygons smaller than 1 ha.

Plots in pasturelands were also measured in the two sites where land-use was more extensive (La Mesa and Las Lajas) but not in the other two sites (Santa Rita and Palmas Bellas), where land-use was scarce. However, there were specific observations noted in La Reina and Palmas Bellas.

Observation Points (OP - to be described later) were made in each recorded plot and also in the coverage and plantations where there were no monitoring plots, or evidence of soil samples taken for analysis. Still, there was a desire to know the vegetation or plantation diversity, even without the detailed precision that stalk measurement permits.

TABLE 8. AMOUNT OF PLOTS PER TYPE OF SPECIES ARRANGEMENT AND YEAR OF PLANTING

Species	Year	Site	Plots
Almendro	N/A	Palmas Bellas	1
		Las Lajas	2
Yellow Cedar	N/A	Santa Rita	1
		Palmas Bellas	1
Mahogany	N/A	Santa Rita	1
Spiny Cedar	N/A	Palmas Bellas	1
		Santa Rita	1
Cocobolo Rosewood	N/A	Palmas Bellas	1
		La Mesa	4
Mixed	N/A	Las Lajas	4
Níspero	N/A	Santa Rita	1
		Las Lajas	1
		Palmas Bellas	2
Teak	2008	Palmas Bellas	1
	2010	Palmas Bellas	1
	2011	Palmas Bellas	1
	2012	Palmas Bellas	1
	2013	Palmas Bellas	1
Zapatero	N/A	Las Lajas	1
		Santa Rita	1
Pastureland	N/A	La Mesa	4
		Las Lajas	4

Source: Field Data 2015.

Plots were not made in all forest covers or types of plantation, although most of them were covered. The other ones were left out mainly because they have a very reduced extension, except for the Cocobolo Rosewood plot in Kapok Farm (Table 3), or because the same type of plantation was found on another farm of the same site. However, in the Palmas Bellas farm, where teak was planted in different years and presented varying levels of development, plots were made to correspond to the planting dates.

Based on the list generated in plots and observation points, an annotated flora list was elaborated for the project (Annex 2) and the plots (Annex 3).

4.2.1 FIELD INFORMATION COLLECTION

Field information was collected in four visits (Table 9), with two quick techniques that can be applied in very diverse situations: the observation points and the plots with their respective field forms (Annex 4).

TABLE 9. TIMELINE OF PROJECT FIELD VISITS

Site	La Mesa	Las Lajas	Santa Rita	Palmas Bellas
Start date of visit	9 – 10 – 2015	9 – 23 – 2015	10 – 8 – 2015	10 – 27 – 2015
End date of visit	9 – 16 – 2015	9 - 28 – 2015	10 - 13 – 2015	11 – 3 – 2015

Observation Point (OP)

With the natural community form (Form II) quantitative information was gathered about the height and coordinates of the point; qualitative information about humidity conditions, texture, color, origin and soil coverage; topography, orientation and slope of the site; vegetation physiognomy and phenology; species dominance per strata and types of habitat; as well as GPS coordinates that were also entered on the form (ANAM, 2008).

Dominant species were also identified via direct field observation; those that were not identified with the naked eye, were assigned a code for subsequent identification.

Plots

The main difference with other projects in which plots have been established is that their selection was not by chance. The plots used were demarcated by plantation monitoring. Hence the dimension also changed, and instead of 2.500 m², we worked with 1.000 m²; adding another difference in that all stalks greater than 1 cm DBH (diameter at breast height) were measured and not only those of 10 cm. Each monitoring plot measures 31,6 m on each side (1.000 m²) and is divided in four sub-plots of 15,8 m (250 m²).

All non-planted tree and shrub species, present in the 1.000 m² plots established on the farms, were recorded. The data gathered in the plots was noted in the plot form (Form III) (Annex 3), taking note of the size, direction, UTM coordinates, altitude and slope of the plot. The species of each individual tree and shrub was identified and recorded, height and diameter measured, for those more than 1 cm DBH.

The data from the observation points and the plots was used to describe the vegetation and make tables to accompany the text. For the final species list, those registered in the following are included: Annex 1 of the Site Form and Annex 2 of the form for natural communities (Annex 3).

4.2.2 BOTANICAL NOMENCLATURE

The nomenclature used in the project is the one used on the websites of Panama's National Herbarium (2015) and the CTSF (Pérez and Condit, 2015), supported by the Catalog of Vascular Plants of Panama (Correa et al., 2004) and the website of the Missouri Botanical Garden (Tropicos, 2015).

The references of most of the descriptions of flora refer to taxa instead of species, due to the large amount of records that only had their identity assigned up to genus or family.

4.2.3 ANALYSIS OF DATA

The collected data, both in the plots as well as observation points, is presented in a list (Annex 2). The lists of species per site, farm, plot or type of plantation are included in the text in order to relate them to the geographic situation, age of the plantation, type of management or any other variable that could affect the number of individuals and species in the plots.

Dominance or diversity indexes were not calculated because the results would be skewed by the plantation, in plots with little regeneration; while in plots with many regeneration stalks — even if the effect of plantation population is less — it is the same to lessen the values of the indexes that would be calculated if compared to similar surfaces of forest patches or heavy brush.

Important Species

The flora species recorded in this research are categorised according to the following criteria: threat, rarity, use, importance and commercial value. Some of these criteria are part of international agreements signed by Panama, such as the CITES Convention, (AL, 1989a, 1989b; ANRC, 1977; JPG, 1972), others are the result of State decisions (ANAM, 2004), and others are gathered from technical classifications (Armién, 2014) or from common knowledge and techniques (Pérez y Condit, 2013).

Species of Forestry Importance

Species according to the criteria of forestry importance, are categorised as *main* and *secondary* (Armién, 2014), to which a category for *potential* must be added. Also, in the species list it is noted whether the species was observed in a plantation or if it established through natural means.

Non-Forest Use Species

Many species have uses as construction materials, food, dyes, fuel, live fences, fodder, medicinal, folkloric, ornamental and even religious. Some of this data derives from works done in areas close to the four sites included in the project (Polanco, 2006; Valdespino and Santamaría, 1999).

For this project, the uses have been divided into food, which includes cultivated plants or those maintained mainly for food. Another category is edible, which encompasses the taxa with potential as a source of food, but that are currently consumed sporadically or in the case of an emergency. Another very common use of wild flora is medicinal, comprising any type of use — internal or external. Many wild plants are used as ornamentals, others serve as live fences, while from others, fibres and construction materials are extracted. There is a group of natural or introduced grasses purposed for fodder in local livestock farming. Another group consists of toxic or irritating plants. Finally, some plants are an excellent source of nectar for honey production.

Each plant was assigned a single use, even though many can offer more than one to the inhabitants of Panama.

Species Protected by International Agreements

This mainly includes the species listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which regulates the trade of wildlife species among signatory countries (CITES, 2015). The species are listed in appendixes, according to their trade restriction, those in Appendix I being the ones that cannot be traded internationally, and those in Appendix II the ones that may be subject to trade under strict regulations.

Species Protected by National Legislation

In this category includes species considered endangered or threatened, according to the information made available by the local authorities and global categories (CITES, IUCN) (ANAM, 2008; UICN, 2015). The list that accompanies the decree that protects national biodiversity is regularly revised to keep it up to date with the most recent and exact information possible.

The IUCN criteria categorise the degree of threat suffered by a species by VU (vulnerable), EN (endangered) and CR (critically endangered), according to the size of populations, their natural dispersal range and the threats they face.

Endemic Species

This category includes species whose global natural dispersal range only includes Panama, according to the available literature (ANAM, 2008; Correa et al., 2004). National endemism is one of the criteria used for the protection of a species.

Exotic Species

Here are included those species that are not native to Panama, but which have been brought here for different purposes. These are species that could become invasive in natural ecosystems, when they no longer have the natural biological controls from their places of origin (ANAM, 2008; Correa et al., 2004; Tropicos, 2015).

The categories for exotic species are C, for the ones that are cultivated — as far as we know, they cannot survive without anthropic support; N, for those that are naturalised, and have managed to extend their dispersal range without human aid; and X, for invasive species that multiply more rapidly than native plants in the place they are colonising.

Indicator Species

As for indicator species, they give an idea of the conditions of sites — good or bad — depending on the location and taxa recorded in the field visits to all four sites. Among the characteristics considered are soil and climate adaptation, presence in the area recorded and abundance in the site.

Other data was taken into account, such as ecological sensibility or resilience, from known sources such as *The Flora of Barro Colorado* (Croat, 1978) and the CTFS website (Pérez and Condit, 2015).

4.3 FAUNA

The fauna considered in this project is limited to resident, migratory or transitory birds that were recorded in all four visited sites, be it within the plots or in the observation points and neighbouring areas. The avifauna for each site was also recorded, that is, outside of the plots and OP.

4.3.1 FIELD INFORMATION COLLECTION

The field data was obtained using two methodologies: intensive search and interviews to workers and dwellers in the visited zones.

Intensive Search

The intensive search consists of a zig zag walk through each type of vegetation, during which the species detected visually or identified by their vocalisations are noted.

Interviews

The information gathered through interviews was gathered with forms designed for this methodology (Annex 3), and was then joined with the data from the intensive search to make an analysis of the fauna component.

The list of birds recorded in the project is presented in Annex 2.

4.3.2 FIELD INFORMATION ANALYSIS

The discussion about the data on birds per site presented here will be presented from the West to the east of the country. In the case of farms located in Las Lajas, Chiriquí (between 25-110 m above sea level) and in La Mesa, Veraguas (between 65-229 m above sea level), they are found on occidental lowlands of the Pacific side of Panama. Both sites are close by, they have similar environments and physical climatic conditions, for which reason it is expected that the bird communities also be similar. Ridgely and Gwynne (1993) point out that bird distribution in lowlands oscillates between elevations, from sea level to about 600 m above sea level.

The farms in Santa Rita, Colón, which are the only ones found on the Caribbean side, occupy elevations above the aforementioned farms (254-395 m above sea level), and the temperature is cooler. Given these characteristics, the bird composition is different compared to the other three sites that are located in lower elevations. Finally, the farms in Palmas Bellas, Darién, located on oriental lowlands of the Pacific side of Panama, are between 93 to 139 m above sea level. As with the site before, because it is located towards the east of Panama its bird compositions will also be somewhat different.

It is important to mention that for the bird composition analysis, we not only took into account the data recorded on the plots, but also data recorded on the edges or surrounding areas of the plantations. For this reason, our analysis takes into account the landscape as a whole, given that birds are animals that move between appropriate habitats.

The database was made on Excel, the Spanish names used are those mentioned in Ridgely and Gwynne (1993). The state of each bird refers to whether the species is a resident (R), that is, it nests and breeds in Panama, or if it is a migratory species (M), meaning it breeds in North America and migrates over/to Panama. Distribution maps for each species were also consulted (Angehr and Dean, 2010).

Important Species

The fauna considered in this project are birds, due to their importance as pollinators and seed and fruit dispersal agents in forests. To record them in this research, the taxonomy of the *Check-list of Birdlife International* (Birdlife International, 2015) was

followed. This check-list includes the latest bird taxonomy (order, family, scientific name) and threat categories according to the International Union for Conservation of Nature (IUCN).

5. RESULTS

The results of the analysis of flora and fauna are presented below as described in the methodology. However, we begin with a general description of the characteristics found in each plot that was visited.

5.1 PLOT DESCRIPTION

The descriptions presented for each plot only refer to the recorded plot and not the plantations to which it belongs, and it emphasises the dominant species — apart from those planted — that were identified but not considered for field data recording.

5.1.1 LA MESA SITE

At this site, three farms were visited and four plantations plots and two pastureland plots were established.

Plot 1, Manuel Castillo Farm

Plot 1 in the Manuel Castillo farm is part of a mixed plantation of native timber and fruit species such as Golden shower tree (*Cassia moschata*), yellow cedar (*Terminalia amazonia*), zapatero (*Hieronyma alchorneoides*), Spiny Cedar (*Pachira quinata*) y Balo (*Gliricidia sepium*) (Annex 2), established in 2011, in a location dedicated to cattle pastures. There are pastures next to the plot, a relatively clean additional mixed plantation surface and a part of the plantation that looks like heavy brush.

The plot is pretty open and has a few shrubs of guayaba sabanera (*Psidium guineense*) and Nance (*Byrsonima crassifolia*), as well as herbs, especially cansa peón (*Borreria latifolia*).

Plot 2, Manuel Castillo Farm

This plot is also part of a mixed plantation of native timber and fruit species: Yellow Cedar, Golden shower tree, Balo, Marmalade box (*Genipa americana*), Guayacan (*Tabebuia guayacan*) and Nance, with a pretty dense cover of cansa peón, which is controlled with glyphosate. Just like plot 1, this one was established on pastureland. Around the plot, other sections of the plantations were observed, as well as a live fence with a few tall trees: (15-20 m) Olivo (*Sapium glandulosum*), Macan (*Diphysa americana*), mango (*Mangifera indica*) and teak (*Tectona grandis*). This plot is very open and the dominant layer consists of grass, dominated by cansa peón.

Plot 3, Manuel Castillo Farm

This plot belongs to a pastureland with some sectors where there is improved pasture and others where there are various herbaceous dicotyledonous species.

In this plot there is no shrub layer and only a few dispersed trees can be seen.

Plot 4, La Torcaza Farm

This plot belongs to a plantation of mixed timber and fruit-bearing native species, such as Yellow Cedar, Marmalade box, oak (*Tabebuia rosea*) and corotú (*Enterolobium cyclocarpum*) and one exotic species (mango). Like the plots before, it was established on pastureland, but in this case the erosion of the land was very obvious. It is surrounded by the rest of the mixed plantations and there are small patches of pasture and remnants of a very altered forest.

As often occurs in other monitoring plots, this plot is "cleaner," meaning that some grasses and shrubs have been eliminated, making it appear much more open than the rest of the plantation. There are numerous guayaba sabanera shrubs and chumico (*Curatella americana*).

Plot 5, Agustín Mendoza Farm

This is a plot located in a mixed plantation of native timber and fruit species: frío (*Colubrina glandulosa*) and cashew (*Anacardium occidentale*), established on pastureland that still maintains the characteristics of the hill pastures in this part of Veraguas, with deep ravines and areas with exposed soil.

This plot is very open with a vast grass cover, as well as numerous individuals of chumico, guayaba sabanera, trompito (*Alibertia edulis*) and dos caras (*Miconia argentea*).

Plot 6, La Torcaza Farm

This is a pasture close to the highway without tree cover, but with patches of riparian secondary forest nearby.

Like the other pasture visited on this site, it has hardly any shrub cover, except for a few guayabos sabaneros.

5.1.2 LAS LAJAS SITE

In this site, five farms were visited and nine plots were established: eight in plantations and one in pastureland.

Plot 1, Carrera Farm

Part of a plantation of mixed native timber and fruit species (yellow cedar, Guayacan, Golden shower tree and zapatero), planted in pastureland. It is surrounded by other

parts of the plantation, pastures, live fences and a mangrove that is dominated by red mangrove (*Rhizophora racemosa*).

This plot has a very clean appearance, with low grass and coronillo (*Bellucia pentamera*) shrubs, a melastomataceae of edible fruit, but no large trees.

Plot 2, Carrera Farm

Also part of the mixed plantations to which plot 1 belongs, but further away from the mangrove. This section of the plantation is more diverse, as we found Guayacan, guachapalí (*Pseudosamanea guachapele*), zapatero, oak, yellow cedar, mahogany (*Swietenia macrophylla*) and Cocobolo Rosewood (*Dalbergia retusa*), and it is surrounded by the rest of the plantation, small patches of heavy brush, and live fences close to the plot.

It is a slightly denser plot than the previous one, the difference lying in the absence of coronillo and a greater presence of Nance. There are also no large trees.

Plot 3, Carrera Farm

This is a pasture that has other pastures, patches of heavy brush and secondary forest as neighbours. It has no large trees, but on the edges outside of the plot there are some jordancillo (*Trema micrantha*) and Trumpet trees.

Plot 4, Los Ríos Farm

According to the personnel that took part of the field visit, this plantation was established in a pasture, but unlike the others, it is monospecific with zapatero. Next to it are sectors of other species plantations such as teak, yellow cedar, spiny cedar and almendro (*Dipteryx oleifera*), as well as pasturelands, heavy brush and secondary forest that includes riparian forest.

It has the appearance of secondary forest, with a very dense undergrowth dominated by a species of gusanillo (*Piper* sp.), as well as oreja de mula (*Miconia impatiolaris*), dos caras, carachero o pintamozo (*Vismia baccifera*) and female malagueto (*Xylopia frutescens*).

Plot 5, Los Ríos Farm

This plot is part of a teak plantation, established on pastureland. It has patches of secondary forest nearby, as well as heavy brush and plantations of yellow cedar, Spiny Cedar and zapatero, along with the rest of the teak plantation.

It has a pretty open undergrowth, dominated by female malagueto and a species from the Rubiaceae family (*Palicourea triphylla*), as well as a Cyperaceae (*Rhynchospora cephalotes*).

Plot 6, Los Ríos Farm

This is a plantation of yellow cedar established in a pasture. It is surrounded by other plantations of yellow cedar, teak and Spiny Cedar. Nearby, are patches of heavy brush and secondary forest, including riparian forest.

It has a relatively dense undergrowth, with one species of Rubiaceae, gusanillo and pasmo (*Siparuna guianensis*).

Plot 7, Madera Fina Farm

This is the oldest of all the plantations visited, and the species used there is yellow cedar. The plantation is relatively small and it is surrounded by pastures, which was the land-use in which it was established. There are also small patches of heavy brush and secondary forest as well as live fences.

It is the plot with the largest trees of all the visited locations. The undergrowth is dense and rich in a variety of species, particularly *pasmo*, cafecillo (*Lacistema aggregatum*), dos caras and alcarreto (*Erythroxylum* sp.).

Plot 8, Concordia Farm

This plot has mixed native timber species (zapatero, yellow cedar, Cocobolo Rosewood and Guayacan). It was also planted on pastureland, and surrounding it, are other sections of the plantation, as well as pastures and secondary forest.

This is one of the plots with the most uneven undergrowth — it is dense in some parts and not in others, it has no vegetation cover outside of the planted species. Some of the most abundant shrubs are Trumpet tree (*Cecropia peltata*), dos caras, cinco negritos (*Lantana camara*) and female malagueto.

Plot 9, Silimín Farm

The plantation to which this plot belongs was established on a pasture. The plantation is of mixed native species (yellow cedar, Guayacan, roble, corotú y Cocobolo Rosewood). It is surrounded by pastures, heavy brush, patches of secondary forest, riparian forest and the rest of the plantation.

This is the plot that looks the most like a plantation — it hardly has trees, there are no grasses, it only has small shrubs. Three species dominate the bush stratum: coronillo, Golden shower tree and Nance.

5.1.3 SANTA RITA SITE

At this site there is a farm, and in it were established five plantation plots and an additional observation point was made. This is the farm in which the largest amount of secondary forest and slightly altered forest were observed.

Plot 1, Santa Rita Farm

This plot is established on an yellow cedar plantation, one of the most recently visited in the entire project. Apparently, it was established on tall heavy brush and has a water stream that flows along one of its sides. All around it is the rest of the yellow cedar plantation as well as patches of secondary forest.

Due to its age, it is the plot with the least vegetation cover of all the visited plots, even though it has some scattered yellow cedar and maría (*Calophyllum brasiliense* y *C. longifolium*) trees. The cut trunks and intense vine regeneration are evident.

Plot 2, Santa Rita Farm

This plot belongs to a mahogany plantation that occupied land where there had been secondary forest and where there used to still be *árboles de mayo* (*Vochysia ferruginea*) standing, but they were banded to be eliminated. Around the plot there are patches of heavy brush and secondary forest, as well as the rest of the plantation.

As in the previous plot, it barely has any undergrowth. It has more scattered maría, mayo, aceituno (*Simarouba amara*) and yellow cedar trees. Unlike the previous plot, the mayos and aceitunos were banded to be eliminated. There is a lot of leaf litter and fallen branches and trees due to thinning and clear-cutting.

Plot 3, Santa Rita Farm

This plot is a Cocobolo Rosewood plantation established on heavy brush, Surrounded by plantations of other species as well as Cocobolo Rosewood and patches of heavy brush and pastureland.

It has some scattered individuals of aceituno, pintamozo and membrillo macho (*Cespedezia spathulata*), with a very entangled undergrowth made up of helechos rastros (Gleicheniaceae). The most common shrubs were corta lengua (*Ryania speciosa*) and cafecillo.

Plot 4, Santa Rita Farm

This is a medlar tree plantation, established in a high heavy brush area where there are still numerous trees without evidence of banding. This is the plot where most stalks were recorded (almost one fifth of all the recorded stalks in the project). Plantations of other species and patches of heavy brush and secondary forest surround it.

As well as being the plot with largest amount of recorded stalks in the project, it also has the largest amount of taxa. The undergrowth is very dense, in fact, the densest of all the visited plots, and the most common shrubs are labios ardientes (*Psychotria poeppigiana* y *P. elata*), canelito (*Isertia haenkeana*), pintamozo and gusanillo.

Plot 5, Santa Rita Farm

This plot is part of a zapatero plantation, established in a young heavy brush and pastureland. A runoff channel goes through the plot. It is surrounded by the rest of the zapatero plantation and other species. There are also patches of heavy brush and secondary forest nearby.

In this plot, banded yuco de monte (*Pachira sessilis*) trees were observed, none of which seem to be affected by banding, as part of the bark was reconnected. The undergrowth is dense, but with a modest number of species. The most numerous shrubs were from the Rubiaceae (*I. haenkeana*, *P. elata* y *P. poeppigiana*) y Melastomataceae (*Miconia affinis* y *Clidemia* sp.) families.

Observation Point 6, Santa Rita Farm

It is within a coco mamey (*Couroupita guianensis*) plantation, practically within the secondary forest. In this point one can observe some trees that were knocked down to let sunlight reach the seedlings, and it is surrounded by secondary forest and the zapatero plantation.

This plantation has no monitoring plot, therefore an observation point was made instead of a plot. It is the point with most tree cover of all the visited sites, however, since it is a secondary forest, the strata are vaguely defined.

The undergrowth is more or less open, with many shrub species or young trees and various species of grass, such as platanilla (*Heliconia longiflora*) and lengua de buey (*Cyclanthus bipartitus*). We observed many felled trees to make the sowing lines of the coco mamey seedlings.

5.1.4 PALMAS BELLAS SITE

In this site there are three farms where eleven plantation plots and an additional observation point were established.

Plot 1, Palmas Bellas Farm

This plot is part of a teak plantation established on pastureland in 2008, surrounded by teak plantations and small patches of heavy brush.

The undergrowth is practically non-existent, except for scattered grass.

Plot 2, Palmas Bellas Farm

This plot is within a teak plantation established in 2012 on heavy brush, surrounded by other parts of the same plantation and patches of secondary forest.

The plot has a denser undergrowth than the last one, and there are other small trees like West Indian Elm (*Guazuma ulmifolia*), poro poro (*Cochlospermum vitifolium*) and jobo (*Spondias mombin*) as well as teak.

Plot 3, Palmas Bellas Farm

Established on a teak plantation in 2010, it is surrounded by the rest of the plantation. There are some felled trees.

This plot also has a sparse undergrowth with some scattered grasses.

Plot 4, Palmas Bellas Farm

This is a teak plantation, established in 2011 on heavy brush. There are numerous felled trunks of West Indian Elm and maquenca (*Coccoloba caracasana*). It is surrounded by the rest of the plantation. The undergrowth has some West Indian Elm, teak, maquenca and guágara (*Sabal mauritiformis*) shrubs and some scattered grasses.

Plot 5, Palmas Bellas Farm

This teak plantation was established in 2013, on heavy brush and pastureland. It is surrounded by plantations from other periods.

The undergrowth in this plot is pretty sparse, with teak, West Indian Elm and nawala (*Carludovica palmata*) individuals.

Plot 6, Reina Farm

This plot is located in a plantation made in 2013 on pastureland. Near the plot are the rest of the plantation, pastureland, live fences and various homes.

The undergrowth has almost no shrubs other than teak, but grasses coat the plot's soil. The most common species are of the family commelinaceae (*Tripogandra* sp. y *Commelian* sp.), escobilla (*Sida* sp.) and a grass (*Echinochloa colona*).

Plot 7, Kapok Farm

This plot is in a yellow cedar plantation that was established in 2008 on heavy brush. It is surrounded by the yellow cedar plantation.

It has a very open undergrowth, but small Trumpet tree (*Cecropia longipes* y *C. peltata*) and mahogany trees.

Plot 8, Kapok Farm

The plot is within an almond plantation, established on heavy brush in 2008. It is surrounded by the rest of the plantation.

This plot has a pretty dense undergrowth, with gusanillo (*Piper tuberculatum*), nawala and platanilla (*Heliconia metallica*).

Plot 9, Kapok Farm

A plot in a teak plantation, established in 2008 in a pastureland zone. The rest of the plantation and a spiny cedar plantation surround it.

The undergrowth of this plot is limited to a few scattered grasses.

Plot 10, Kapok Farm

This plot is in a Cocobolo Rosewood plantation that was established in 2008 on pastureland. It has half the surface of the rest of the plots because the Cocobolo Rosewood plantation is small. But since it has a monitoring plot, data was recorded. It is next to a teak and Spiny Cedar plantation.

It has a somewhat dense undergrowth, dominated by gusanillo and young West Indian Elms, Trumpet tree, mora (*Maclura tinctoria*) and palma real (*Attalea butyracea*).

Plot 11, Kapok Farm

This plot was recorded on a Spiny Cedar plantation, established in 2008 on pastureland. It is surrounded by the rest of the Spiny Cedar plantation and a teak plantation. At the beginning of 2015, hurricane-force winds knocked down many trees on the plantation.

Due to the fallen trees, there are hardly any shrubs but there is an aggressive regeneration of vines, especially bejuco de agua (*Cissus erosa* y *C. verticillata*), espino de vaca (*Pithecellobium hymenaeifolium*) and *Serjania* sp.

Observation Point 12, Palmas Bellas Farm

It belongs to an old secondary forest, dominated by Cuipo (*Cavanillesia platanifolia*) and cottonwood tree (*Ceiba pentandra*), with guágara, guácimo colorado (*Luehea seemannii*) and rubber (*Castilla elastica*) trees in the canopy and lower tree strata.

All the strata of this forest, including the undergrowth, are very dense and the amount of vines is greater than in more mature forests. On the other hand, epiphytes are rare while hemiepiphytes of genus *Monstera*, *Syngonium* and *Philodendron* are common.

5.2 FLORA

The results of the flora analysis are presented below.

5.2.1 SPECIES RICHNESS

During the visits 634 taxa were recorded, distributed in 476 of class Magnoliopsida (dicotyledonous), 132 Liliopsida (monocotiledoneous), one of Pinopsida (gymnosperm), 23 of class Filicopsida (ferns) and two of Lycopodiopsida (Lycopodium). No information was recorded about non-vascular plants such as mosses, algae or hepatic plants. The distribution of these taxa by site is presented in Annex 2. Of these taxa, nine were recorded in the four visited sites, while on the other extreme, 464 taxa were exclusive to some of the sites of the project.

Flora Richness per Site and Plot

Diversity in the plots, as was expected, is far less than what was recorded for the whole project, because only large bushes and trees were recorded - with 184 taxa, of which 176 belong to class Magnoliopsida, seven to Liliopsida and one to Filicopsida (Annex 3).

The distribution of taxa per site was the following: Santa Rita (121 taxa, 65,8% of the total), followed by Las Lajas (66 taxa, 35,9%). Far behind were La Mesa (15 taxa, 8,2%) and Palmas Bellas (14 taxa, 7,6%).

Next are the records per site and plot (Table 9), where great numbers of recorded stalks stand out in the Santa Rita and Las Lajas plots (Madera Fina, Silimín y Los Ríos).

On the contrary, the only plot with zero records was in Palmas Bellas (Kapok), except for the expected record in pasturelands. Moreover, the next five plots with less than five records were in Kapok and Palmas Bellas.

Regarding the number of species, the three plots with the largest number of taxa were found in Santa Rita (73, 46 and 44), followed by a plot in Las Lajas (40); while the plots with the least number of taxa are in Palmas Bellas: one has zero taxa, four plots have one taxon, and another has two taxa (Table 10).

The rest of the plots range between three and twenty taxa, Palmas Bellas being the only site where all the plots have less than 10 taxa, and the La Mesa site, where only one plot reached that number of taxa.

When we related the number of records with the number of taxa, in general we observed that the larger the number of records, the greater the richness — but there is a notable exception in Las Lajas, where the Silimin Farm has one of the greatest amounts of records (209) with only six taxa.

TABLE 10. AMOUNT OF TAXA AND INDIVIDUALS PER SITE AND PLOT

Farm and Site	Plot N°	Type	Area (m ²)	n	s
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Manuel Castillo	1	Mixed	1.000	7	4
Manuel Castillo	2	Mixed	1.000	11	6
Manuel Castillo	3	Pasture	1.000	0	0
La Torcaza	4	Mixed	1.000	6	3
Agustín Mendoza	5	Mixed	1.000	29	10
La Torcaza	6	Pasture	1.000	0	0
La Mesa		1	6.000	53	15
Carrera	1	Mixed	1.000	73	12
Carrera	2	Mixed	1.000	42	11
Carrera	3	Pasture	1.000	0	0
Los Ríos	4	Zapatero	1.000	183	18
Los Ríos	5	Teak	1.000	106	13
Los Ríos	6	Yellow Cedar	500	61	18
Madera Fina	7	Yellow Cedar	1.000	252	40
Concordia	8	Mixed	1.000	99	14
Silimín	9	Mixed	1.000	209	6
Las Lajas		4	8.500	1.025	67
Santa Rita	1	Yellow Cedar	1.000	6	3
Santa Rita	2	Mahogany	1.000	63	20
Santa Rita	3	Cocobolo Rosewood	1.000	116	44
Santa Rita	4	Níspero	1.000	329	73
Santa Rita	5	Zapatero	1.000	112	46
Santa Rita		5	5.000	626	122
Palmas Bellas	1	Teak 2008	1.000	3	1
Palmas Bellas	2	Teak 2012	1.000	24	6
Palmas Bellas	3	Teak 2010	1.000	1	1
Palmas Bellas	4	Teak 2011	1.000	17	4
Palmas Bellas	5	Teak 2013	1.000	4	3
Reina	6	Teak	1.000	4	1
Kapok	7	Yellow Cedar	1.000	13	4

Kapok	8	Almendro	1.000	2	1
Kapok	9	Teak	1.000	0	0
Kapok	10	Cocobolo Rosewood	500	10	4
Kapok	11	Spiny Cedar	1.000	10	2
Palmas Bellas		5 *	10.500	88	14
Total	31	10 *	30.000	1.792	186

Source: Field data, 2015. Key: * includes 5 ages of teak plantation

The similarity of taxa between the sites is very low, and among the calculations made, the greatest similitude was between the La Mesa and Las Lajas sites (Table 11), despite the great difference in number of taxa in both sites. Instead, among the plots of each site, the largest range was in Palmas Bellas, where the values oscillated between 100 and 0%.

TABLE 11. SØRENSEN SIMILARITY INDICES PER SITE

Sites	Species Shared	Species		C
		Site A	Site B	
La Mesa and Las Lajas	9	15	67	21,95
La Mesa and Santa Rita	4	15	121	5,88
La Mesa and Palmas Bellas	1	15	14	6,90
Las Lajas and Santa Rita	18	67	121	19,15
Las Lajas and Palmas Bellas	4	67	14	9,88
Santa Rita and Palmas Bellas	2	121	14	2,96

Source: Field data, 2015

The greatest similarity was between La Mesa and Las Lajas, which are the two closest sites. While the least similar were Santa Rita and Palmas Bellas, despite being the sites with the highest relative humidity average (Table 4) even though they are very distant in rainfall.

Per plot, the greatest similarity in La Mesa is between La Torcaza and Agustín Mendoza plots; in Las Lajas it is between the Los Ríos teak plot and the Silimin plot; while in Santa Rita the plots with the greatest flora similarity were the ones with níspero and zapatero; and finally in Palmas Bellas, similarity was 100% between the

2008 and 2010 teak plots in the Palmas Bellas farm and the teak plot in Reina farm, as they only share one species: teak.

Taxa and Individuals

When one compares the number of taxa per plot compared to the OP (Table 12), the number of species on the plot does not predict the number of species in the OP, due to the great variation in grass taxa present at the OP which are not recorded in the plots.

On the other hand, the number of individuals in one plot also does not allow the prediction of the number of species in it, even though the general and logical tendency veers towards the greater the number of stalks, the greater the number of species should be - Plots 4, 9, 8 and 5 in Las Lajas have many individuals (between 99 and 209), but few species (between 6 and 18). For the rest of the plots, the mentioned plots are not taken into account. Therefore, the number of stalks becomes a trustworthy predictor of the number of species in a plot.

TABLE 12. NUMBER OF TAXA AND INDIVIDUALS PER PLOT AND OBSERVATION POINT

Farm and Site	Plot N°	Type	Area (m ²)	n	s	s (OP)
Manuel Castillo	1	Mixed	1.000	7	4	34
Manuel Castillo	2	Mixed	1.000	11	6	38
Manuel Castillo	3	Pasture	1.000	0	0	19
La Torcaza	4	Mixed	1.000	6	3	31
Agustín Mendoza	5	Mixed	1.000	29	10	28
La Torcaza	6	Pasture	1.000	0	0	12
La Mesa			6.000	53	15	101
Carrera			1.000	73	12	31
Carrera	2	Mixed	1.000	42	11	42
Carrera	3	Pasture	1.000	0	0	21
Los Ríos	4	Zapatero	1.000	183	18	34
Los Ríos	5	Teak	1.000	106	13	37
Los Ríos	6	Yellow Cedar	500	61	18	42
Madera Fina	7	Yellow Cedar	1.000	252	40	52
Concordia	8	Mixed	1.000	99	14	33

Silimín	9	Mixed	1.000	209	6	26
Las Lajas			8.500	1.025	67	190
Santa Rita	1	Yellow Cedar	1.000	6	3	54
Santa Rita	2	Mahogany	1.000	63	20	72
Santa Rita	3	Cocobolo Rosewood	1.000	116	44	64
Santa Rita	4	Níspero	1.000	329	73	127
Santa Rita	5	Zapatero	1.000	112	46	101
Santa Rita	6	Observation Point	7.854	...	...	38
Santa Rita			12.854	626	122	301
Palmas Bellas	1	Teak2008	1.000	3	1	47
Palmas Bellas	2	Teak	1.000	24	6	46
Palmas Bellas	3	Teak 2010	1.000	1	1	16
Palmas Bellas	4	Teak2011	1.000	17	4	29
Palmas Bellas	5	Teak 2013	1.000	4	3	43
Reina	6	Teak	1.000	4	1	37
Kapok	7	Yellow Cedar	1.000	13	4	63
Kapok	8	Almendro	1.000	2	1	55
Kapok	9	Teak	1.000	0	0	34
Kapok	10	Cocobolo Rosewood	500	10	4	45
Kapok	11	Spiny Cedar	1.000	10	2	73
Palmas Bellas	12	Observation Point	7.854	...	...	80
Palmas Bellas			18.354	88	14	283
Total			45.708	1.972	186	637

Source: Field data, 2015

Plantation Characteristics and Taxa

The age of the plantation had no connection with the number of taxa or individuals in a plot (Table 6). On the other hand, the plot surroundings do not allow the prediction of the number of expected taxa for one plot (Table 6). Likewise, the land use or cover that existed prior to plantation establishment also holds no connection with the number of individuals and taxa in a plot.

The only apparent connection is in the sites, where the site with the apparently largest amount of forest next to the plantations is the one that presents the greatest number of taxa and the second greatest amount of stalks. Older plantations have the greatest amount of stalks and the second greatest amount of taxa.

5.2.2 IMPORTANT SPECIES

Based on the records obtained in field visits for the project, there are 272 flora taxa in some category of importance. This great number of taxa (42,9% of the total recorded) has been divided by category for the sake of better information clarity.

Species of Forestry Importance

Of the total number of taxa recorded in field visits, 44 are of known commercial importance in the country (Table 13). Many of them correspond to those planted because, even if they were not counted, they were recorded as part of the information obtained in the observation points.

Of the 43 species of forestry importance that were recorded, 17 have been planted in one or more visited plots; while 24 have appeared, apparently spontaneously, in many of the visited plots; and two species were recorded outside of the plots and are part of the site's general information.

Considered by site, the largest number of spontaneous species was recorded in Santa Rita (12), followed by Las Lajas and Palmas Bellas (10) and lastly, La Mesa (two). While, when considered by planted species, the order inverts slightly and it is Las Lajas that has the most species (14), followed by La Mesa (12), Palmas Bellas (11) and Santa Rita (7).

The forestry species recorded outside of the plots were in La Mesa (caoba africana) and Santa Rita (pino caribe).

Other species recorded in plots, observation points or sites, are also used for wood but not as a main use — as is the case of Nance, Guayacan (*Tabebuia ochracea*) and one of the nazarenos (*Jacaranda caucana*).

As it occurs with most of the following categories, many of the species are also included in other categories within this section, such that the sum of totals per category is greater than the initial figure of 272 taxa.

TABLE 13. TAXA FOR FORESTRY IMPORTANCE

Name			Common Name	Origin
Class Magnoliopsida	Family Anacardiaceae	<i>Anacardium excelsum</i>	espavé	Planted
		<i>Astronium graveolens</i>	zorro	Spontaneous

	Name		Common Name	Origin
	Family Apocynaceae	<i>Aspidosperma sp.</i>	alcarreto	Spontaneous
	Family Bignoniaceae	<i>Tabebuia guayacan</i>	Guayacan	Planted
		<i>Tabebuia ochracea</i>	Guayacan	Planted
		<i>Tabebuia rosea</i>	roble de sabana	Planted
	Family Boraginaceae	<i>Cordia alliodora</i>	laurel	Planted
		<i>Cordia bicolor</i>	muñeco	Spontaneous
		<i>Cordia collococca</i>	muñeco	Spontaneous
		<i>Cordia panamensis</i>	muñeco	Spontaneous
	Family Clusiaceae	<i>Calophyllum brasiliense</i>	maría	Spontaneous
		<i>Calophyllum longifolium</i>	maría	Spontaneous
		<i>Symphonia globulifera</i>	cerillo	Spontaneous
	Family Combretaceae	<i>Terminalia amazonia</i>	yellow cedar	Planted
		<i>Terminalia oblonga</i>	guayabillo	Spontaneous
	Family Euphorbiaceae	<i>Hieronyma alchorneoides</i>	zapatero	Planted
	Family Fabaceae	<i>Albizzia niopoides</i>	fijolillo	Planted
		<i>Copaifera aromatica</i>	cabimo	Planted
		<i>Dalbergia retusa</i>	Cocobolo Rosewood	Planted
		<i>Diphysa americana</i>	Macan	Spontaneous
		<i>Dipteryx oleifera</i>	almendro de montaña	Planted
		<i>Enterlobium cyclocarpum</i>	corotú	Planted
		<i>Enterolobium schomburgkii</i>	jarina	Spontaneous
		<i>Hymenaea courbaril</i>	algarrobo	Spontaneous
		<i>Peltogyne purpurea</i>	nazareno	Spontaneous
		<i>Platymiscium pinnatum</i>	quira	Spontaneous
		<i>Pseudosamanea guachapele</i>	guachapalí	Planted
		<i>Vatairea erythrocarpa</i>	amargo amargo	Spontaneous
	Family Lamiaceae	<i>Tectona grandis</i>	teca	Planted
	Family Lecythidaceae	<i>Couroupita guianense</i>	Coco mamey	Planted
	Family Magnoliaceae	<i>Talauma sp.</i>	baco	Spontaneous
	Family Malvaceae	<i>Pachira quinata</i>	spiny cedar	Planted
	Family Meliaceae	<i>Cedrela odorata</i>	cedro amargo	Spontaneous

Name			Common Name	Origin
		<i>Guarea</i> sp.	cedro macho	Spontaneous
		<i>Khaya</i> sp.	caoba africana	Outside of plot
		<i>Swietenia macrophylla</i>	mahogany	Planted
	Family Moraceae	<i>Brosimum alicastrum</i>	berbá	Spontaneous
		<i>Maclura tinctoria</i>	mora	Spontaneous
	Family Myristicaceae	<i>Virola sebifera</i>	miguelario	Spontaneous
	Family Rhamnaceae	<i>Colubrina glandulosa</i>	frío	Planted
	Family Rutaceae	<i>Zanthoxylum acuminatum</i>	arcabú	Spontaneous
		<i>Zanthoxylum ekmanii</i>	arcabú	Spontaneous
		<i>Zanthoxylum setulosum</i>	arcabú	Spontaneous
	Family Sapotaceae	<i>Manilkara bidentata</i>	níspero	Planted
Class Pinopsida	Family Pinaceae	<i>Pinus caribaea</i>	pino caribe	Outside of plot

Source: Field data, 2015, Armién, 2014, Pérez and Condit, 2015

Species not used for Forestry

This is the largest group of taxa: 213 - meaning 78,3% of the taxa included in the species of importance. Of this group, the most numerous set is for traditional medicinal use (55). The next plant grouping corresponds to ornamental use (46), followed by plants with nutritional potential (33) and those that are already used for food (30).

The least numerous sets are those with plants that provide fibres and materials for crafts (16); grasses (11), those that are toxic or urticating (10), those used for live fences (9) and melliferous plants (3).

In the distribution of taxa with some type of use per site, the greatest amount is found in Palmas Bellas (130) and Santa Rita (118), followed by Las Lajas (86) and La Mesa (67). The details of the distribution of these groups per site visited are presented in Table 14.

TABLE 14. TAXA NOT USED FOR FORESTRY PER SITE

Current or Potential use	Site				Taxa Total
	La Mesa	Las Lajas	Palmas Bellas	Santa Rita	
Food	14	7	18	8	30
Edible	3	9	21	13	33

Fibres / Materials	5	8	9	9	15
Melliferous	1	3	2	2	3
Ornamental	12	10	16	21	46
Grasses	6	3	5	2	11
Medicinal	6	16	24	29	55
Toxic	0	0	8	4	10
Live fences	6	4	6	2	9

Source: Field data 2015, Pérez and Condit, 2015, Geilfus, 1989; León, 1987

Species Protected by International Conventions

This category includes species protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2015). Thirty taxa protected by CITES were recorded during the field visits, two of which are included in Appendix I: la flor del espíritu santo (*Peristeria elata*) and the árbol suicida (*Tachigali versicolor*), both recorded outside of the Santa Rita plots.

The other 28 taxa correspond to 24 orchids, two cacti, mahogany and one tree fern, found in La Mesa (2), Las Lajas (10), Palmas Bellas (4) and Santa Rita (17).

Species protected by National Legislation

As for species protected by national legislation (ANAM, 2008), twenty-eight species were recorded. One of them is considered to be critically endangered in the wild: mahogany. While Cocobolo Rosewood is considered endangered. The rest of the species are considered vulnerable due to the threats they are confronted with - loss of habitat, internal trade, and decline in their populations.

Endemic Species

Only two endemic species were recorded: one bromeliad (*Guzmania musaica*) in Santa Rita and one tree that is potentially useful for tinder, arcabú (*Zanthoxylum acuminatum*), in Palmas Bellas. In both cases, they were found outside of the plots.

Exotic Species

Exotic species are a necessary topic for Panama's lifestyle and agriculture. It is surprising how few taxa are in this category, as we expected to find more than the 26 taxa recorded. Most of them are naturalised species (19). Palmas Bellas and La Mesa are the sites with most exotic species - 13 and 10 taxa respectively - followed by Santa

Rita (8) and Las Lajas (5). It is worth mentioning that mango was the only exotic species found in all four visited sites.

Indicator Species

Indicator species are shown per site according to each of their distinctive conditions, despite similarities in some physical, climatic, biological or management characteristics (Tables 3, 4, 5 and 6).

La Mesa: the combination of Nance, chumico, guayaba sabanera and faragua indicates that the area has no forest cover and it tends to suffer from periodic fires. Two of those species are also found in the other sites, and their function as elements of more humid or cool areas is conditioned by the age and development of the Nance trees (they grow up to 20m or more within a forest), since the chumico is limited to open areas because it cannot stand prolonged shade.

At this site, any additional species is a step towards forest regeneration and can be considered an indicator of increase in biodiversity and of improvement of the site's ecological conditions.

Las Lajas: due to its species richness it is a little more complicated to choose indicator species. However, considering the proximity of secondary forests in almost all plots, those that stand out are cafecillo and various Rubiaceae species, given that these are generally associated with forests and do not prosper in open sites.

On the other hand, the presence and abundance of coronillo, Golden shower tree, lengua de buey, chumico and malaguetos is a sign that there was recent disturbance in the site which eliminated most of the species that are present.

San Rita: because it is the most humid, cool, elevated and the only site on the Caribbean side, most of the taxa recorded are indicators of humid zones. However, the presence of membrillo macho, raspa lengua, lengua de buey, Nance and mayo indicate that there have been recent disturbances in the vegetation.

On the other hand, due to the presence of ahotillo, berbá, maría, palmito, sauquillo, baco, cerillo, jarina and labios ardientes, it can be said that the site has suffered slow decay (if there are large trees) or that it is on the way to regeneration (if there are young trees).

Palmas Bellas: has very few species and many of them have a wide ecological tolerance, but we were able to identify a few that indicate recent disturbance: Trumpet tree and young guágara and Cuipo.

The presence of not planted mahogany is symbolic, because it is a species that in its natural distribution is associated with forests and is rarely found in wilderness areas. To find young palm trees, chutr  y malagueto de mont a can also be indicators of a good quality habitat.

5.3 AVIFAUNA

Below are the results of the work done on flora and avifauna, as described in the methodology.

5.3.1 SPECIES RICHNESS PER SITE

This section presents the relationship of species per site visited, from West to East, as indicated.

Las Lajas, Chiriqu 

The farms include a variety of environments (or land use and cover) associated with native species timber plantations (yellow cedar, oak, Cocobolo Rosewood, zapatero and Guayacan, etc.) and fruit trees (Nance), which are appropriate habitats for some birds. We also refer to some open areas with/without grasses and pastures (pastureland), natural regeneration areas (heavy brush), remnants of altered forests (secondary forests) and isolated trees.

Following the description of the structure of vegetation on the farms and the aerial photographs of this report, we can point out that the landscape includes various types of habitat configurations that could bring about connectivity or the movement of birds towards other habitats. According to Bennett (2004), among the diverse types of habitat configuration we identified a few in the area of study:

Live fences. Existing in almost all the farms.

Riparian forest. As in the case of the Los R os and Similin Farms.

Mangrove Forest. As in the case of Carrera Farm, which is contiguous to fragments of red mangrove.

Eighteen species were recorded, of which the following can be mentioned:

Birds typically found in open areas and pastureland:

The only observation corresponds to the white-tipped dove (*Leptotila verreauxi*), which is a very common species of wide distribution that feeds on vegetable matter (Ridgely and Gwynne 1993).

Birds that feed on fruit:

These farms are often associated with secondary forests and heavy brush, which can provide a certain number of plants with edible fruit for birds, such as coronillo (melastomataceae), gusanillo (piperaceae), various Rubiaceae and Trumpet tree. But there are also fruit trees such as Nance, whose fruits are very attractive for species of tanagers that include a high percentage of fruit in their diet. The birds recorded at this site were blue-grey tanager (*Thraupis episcopus*), scarlet tanager (*Piranga olivacea*) which is a long-distance migratory species, plain-colorer tanager (*Tangara inornata*), red-crowned Ant tanager (*Habia rubica*), and a species locally called “bin-bin”, which refers to yellow-crowned Euphonia (*Euphonia luteicapilla*).

Fruit-eating birds are important for seed dispersal and maintaining plant species. According to Howe (1993), dispersion is the exiting of one seed from the mother plant, while the dispersing agents are the animals that move the viable seeds from one location to another.

Bird Specialties:

The bird specialty for this site is represented by the Dusky Antshrike (*Thamnophilus bridgesi*), a regional endemic species found only in Costa Rica and the western Pacific side of Panama (Angehr, 2003). It is a species that prefers to feed on insects and lives in the undergrowth of secondary forest, in gallery forests and mangroves (Ridgely and Gwynne, 1993).

Van Bael et. al. (2013) holds that while deforestation remains a threat to the diversity of species in the tropics, there are parallel reforestation processes going on, either through natural regeneration or through forest plantations, of which very little is known regarding how these influence bird communities.

How near or far forested areas are from reforestation or plantations will influence the abundance of birds. In the Agua Salud project that took place in Soberania National Park in the middle of Panama, Van Bael et. al. (2013) counted more birds in the reforested areas near the mature forest than in the areas far away from the mature forest.

La Mesa, Veraguas

The farms contain a variety of environments (or land use and cover) associated with native species timber plantations (yellow cedar, spiny cedar and Guayacan, etc) and fruit trees (Nance, cashew and mango, etc), which are appropriate habitats for some bird species. We also refer to some open areas with/without grasses and pastures (pastureland), areas of natural regeneration (heavy brush), remnants of altered forests and isolated trees.

Following the description of the structure of vegetation on the farms and the aerial photographs of this report, we can point out that the landscape includes various types of habitat configurations that could bring about connectivity or movement of birds towards other habitats. According to Bennett (2004), among the diverse types of habitat configuration, we identified a few in the area of study:

Live fences. In the Manuel Castillo Farm (plot 2) the live fence contains some tall Olivo, Macan and Teak trees, and some fruit trees like mango.

Riparian Forest. The covers of La Torcaza Farm (plot 6) are associated with patches of riparian secondary forest.

In these farms 26 species were recorded, of which the following stand out:

Birds typically found in open areas and pastureland:

At least seven bird species were identified that relate to this type of habitat (Table 15). Those that stand out are one quail, two doves, one **colaespina**, one **pastorero**, **un pinzón and one semillero**. These species feed on grass' small seeds, which are controlled with chemical products (glyphosate), leading therefore, to the disappearance of these species as their natural source of food is eliminated.

TABLE 15 BIRD SPECIES TYPICAL OF OPEN AREAS IN LA MESA, VERAGUAS

	Family	English Name	Scientific Name
1.	Odontophoridae	Crested bobwhite	<i>Colinus cristatus</i>
2.	Columbidae	White-tipped dove	<i>Leptotila verreauxi</i>
3.	Columbidae	Ruddy ground dove	<i>Columbina talpacoti</i>
4.	Furnaridae	Pale-breasted spintail	<i>Synallaxis albescens</i>
5.	Icteridae	Eastern meadowlark	<i>Sturnella magna</i>
6.	Emberizidae	Wedge-tailed grass finch	<i>Emberizoides herbicola</i>
7.	Emberizidae	Blue-black grassquit	<i>Volatinia jacarina</i>

Source: Field data, 2015

The specialty of this site, both for the west of Panama as for this type of habitat, is the pinzón-yerberero colicuña, whose photographic records show it is found at a lower elevation in the west of Panama than mentioned by Angehr and Dean (2010), 600-1100 m above sea level.

Birds that feed on fruit:

The presence of fruit trees such as: Nance, mango and cashew among others, is very attractive to species that include a high percentage of fruit in their diets, like the crimson-backed tanager (*Ramphocelus dimidiatus*), blue-grey tanager and the clay-coloured thrush, even though they also compliment their diet with insects. Fruit-eating birds are important for seed dispersal and maintaining plant species.

Birds in heavy brush (natural regeneration) and altered forests:

In this type of environment, the presence of the swallow-tailed (Blue) Manakin (*Chirophixia lanceolata*) stands out — a fruit-eating species, that depends on the natural regeneration of forests from the heavy brush and scrub phase.

Santa Rita, Colon

The farms include a variety of environments (or covers) associated with native timber species (yellow cedar, mahogany and Cocobolo Rosewood, etc.), which are appropriate habitats for some bird species. We are referring to some areas with natural regeneration (heavy brush), remnants of altered forest (secondary forests) and slightly altered forests. Of all the farms, the ones on this site are the only ones whose origin was not pastureland, but heavy brush and secondary forest, which is why there are few open areas with/without grasses and pasture, as data shows.

As opposed to the previous farms, these have a larger extension (360 has) that contains various types of vegetation cover, which makes them blend into the landscape that has a rather uniform vegetation cover.

Twenty-one species were recorded on these farms, of which we can mention the following:

Birds typically found in open areas and pastureland:

None were recorded.

Birds that feed on fruit:

These farms are associated with areas of natural regeneration (heavy brush) and remnants of altered forests (secondary forest) and slightly altered forests, which contribute a certain number of fruit-bearing plants, such as *Miconia affinis* and *Clidemia* sp. (a few Melastomataceae), gusanillo (a piperaceae) and various Rubiaceae, among others, whose fruits are very attractive to tanagers. At this site the following birds were recorded: blue-grey tanager, scarlet tanager — which is a long-distance migratory species, the olive tanager, and the clay-coloured thrush. Although this last one also compliments its diet with insects. Fruit-eating birds are important for seed dispersal and maintaining plant species.

Bird Specialties:

The bird specialty for this site is the gray catbird, a long-distance migratory bird whose distribution reaches only as far as Panama. This is a species that prefers to feed on insects (though it eats some fruit) and lives in thickets and shrubs (Ridgely and Gwynne, 1993).

Palmas Bellas, Darién

The farms include a variety of environments (or land uses and covers) associated with plantations of native timber species (Yellow Cedar, spiny cedar and almendro, etc) and fruit trees (jobo, Trumpet tree, etc) which are appropriate habitats for some bird species. We referred to some open areas with/without grasses and pastures (pastureland), areas with natural regeneration (heavy brush), remnants of altered and slightly altered forests. For instance, OP No. 12 which was part of a forest with very defined strata — for example, canopy trees like Cuipo, cottonwood tree and West Indian Elm colorado were recorded, while the rest of the strata were very dense, including the undergrowth.

Based on the description of the vegetation structure of the farms and the aerial photographs presented in this report, we can point out that the landscape that makes up these farms and their surroundings takes live fences into account, as one of the many types of habitat configurations that could foster bird connectivity and movement towards other habitats (Bennet, 2004). Live fences are observed in most farms.

At these farms, 29 species were recorded, of which the following stand out:

Birds typically found in open areas and pastureland:

At least two dove species were identified: white-tipped dove and the ruddy ground-dove, which are very common species of wide distribution that feed on vegetable matter (Ridgely and Gwynne 1993).

Birds that feed on fruit:

These farms are associated with areas of natural regeneration (heavy brush) and altered forest remnants (secondary forests) and slightly altered forests, which provide a certain number of fruit-bearing plants that are edible for birds such as jobo and Trumpet tree, etc. whose fruit are attractive to species such as the Gray-headed chachalaca (*Ortalis cinereiceps*), Orange-chinned Parakeet (*Brotogeris jugularis*), Red Lored Amazon (*Amazona autumnalis*), Yellow-crowned Amazon, Green manakin (*Xenopipo holochlora*) and the blue-grey tanager. Fruit-eating birds are important for seed dispersal and maintaining plant species.

Bird Specialties:

The bird specialty for this site is the Green Manakin, a fruit-eating species, characteristic of the eastern forests of Panama.

5.3.2 IMPORTANT SPECIES

Next, we highlight important species for conservation that were recorded in this project.

Las Lajas

Three species were recorded, of which two hummingbirds and one toucan stand out. They are: the Long-billed Hermit (*Phaethornis longirostris*), the Sapphire-throated hummingbird (*Lepidopyga coeruleogularis*) and the Keel-billed toucan (*Ramphastos sulfuratus*), all three considered vulnerable (VU) according to the national threat criteria of the National Environment Authority (ANAM, now called Ministry of the Environment, or Mi Ambiente), and they are found in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It is worth mentioning that hummingbirds are pollinators, while the toucan is a species that disperses large seeds.

La Mesa

Five species were observed in La Mesa: (one hummingbird, one raptor and three parrots/parakeets), all four considered vulnerable (VU) according to the national threat criteria of the National Environment Authority (ANAM, now called Ministry of the Environment, or Mi Ambiente), and they are found in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It is worth mentioning that the two parrot species are typical of occidental Panama, while the other three are of wide distribution - Table 16.

TABLE 16. THREATENED BIRD SPECIES IN THE SITE OF LA MESA, VERAGUAS

	Family	English Name	Scientific Name	EAP	CITES
1.	Trochilidae	Garden Emerald	<i>Chlorostilbon assimilis</i>	VU	II
2.	Falconidae	Yellow-headed caracara	<i>Milvago chimachima</i>		II
3.	Psittacidae	Yellow-crowned Amazon	<i>Amazona ochrocephala</i>	VU	II
4.	Psittacidae	Brown-throated Parakeet	<i>Eupsittula pertinax</i>	VU	II
5.	Psittacidae	Finsch's Parakeet	<i>Aratinga finschi</i>	VU	II

Source: Field data 2015

Santa Rita

At this site seven species were found, of which three hummingbirds, two raptors and one toucan stand out. All are considered vulnerable (VU) according to the national threat criteria of the National Environment Authority (ANAM, now called Ministry of the Environment, or Mi Ambiente), and they are found in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Table 17). It is worth mentioning that hummingbirds are pollinating agents, raptors are biological pest controllers, while the toucan is a disperser of large seeds.

TABLE 17. THREATENED BIRD SPECIES IN THE SITE OF SANTA RITA, COLÓN

	Family	English Name	Scientific Name	EAP	CITES
1.	Trochilidae	White-necked Jacobin	<i>Florisuga mellivora</i>	VU	II
2.	Trochilidae	Sapphire-throated Hummingbird	<i>Lepidopyga coeruleogularis</i>	VU	II
3.	Trochilidae	Violet-crowned Woodnymph	<i>Thalurania colombica</i>	VU	II
4.	Trochilidae	Sapphire-throated Hummingbird	<i>Lepidopyga coeruleogularis</i>	VU	II
5.	Pandionidae	Osprey	<i>Pandion haliaetus</i>	VU	II
6.	Accipitridae	Tiny Hawk	<i>Accipiter superciliosus</i>	VU	II
7.	Ramphastidae	Keel-billed Toucan	<i>Ramphastos sulfuratus</i>	VU	II

Source: Field Data 2015

Palmas Bellas

In Palmas Bellas seven species were recorded, of which one hummingbird, three raptors and three parakeets/parrots stand out. All species are considered vulnerable (VU) according to the national threat criteria of the National Environment Authority (ANAM, now called Ministry of the Environment, or Mi Ambiente), and they are found in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Table 18). It is worth mentioning that hummingbirds are pollinating agents, raptors are biological pest controllers, while parrots and parakeets are seed disperser species that could spread out over large distances.

TABLE 18. THREATENED BIRD SPECIES IN THE SITE OF PALMAS BELLAS, DARIÉN.

	Family	English Name	Scientific Name	EAP	CITES
1.	Trochilidae	Sapphire-throated Hummingbird	<i>Lepidopyga coeruleogularis</i>	VU	II

2.	Accipitridae	Great black Hawk	<i>Buteogallus urubitinga</i>	VU	II
3.	Accipitridae	Roadside Hawk	<i>Rupornis magnirostris</i>	VU	II
4.	Falconidae	Slaty-backed Forest Falcon	<i>Micrastur mirandollei</i>	VU	II
5.	Psittacidae	Orange-chinned Parakeet	<i>Brotogeris jugularis</i>	VU	II
6.	Psittacidae	Red-lored Amazon	<i>Amazona autumnalis</i>	VU	II
7.	Psittacidae	Yellow-crowned Amazon	<i>Amazona ochrocephala</i>	VU	II

Source: Field data 2015

6. CONCLUSIONS

- The site with most flora species richness in its plots was Santa Rita, which is the one with more natural forest, it is also the coolest with the most rainfall of all four visited sites.
- No correlation was found between the orographic or climatological conditions and the number of individuals or taxa in the plots and sites.
- Also, no relation was observed between the species or groups of species planted and the number of individuals and taxa in the plots and sites.
- Chemical control can eliminate many of the taxa that would be colonising the more recent plots, leaving only the most tolerant to this disturbance.
- Plantations in the La Mesa site have very little regeneration of non-planted trees, possibly due to the poor levels of flora in surrounding areas.
- The Las Lajas site presented some of the plots with the largest number of recorded individuals and identified taxa, partly due to the age of the plantations, climatic and management factors.
- The plots with least regeneration were found in Palmas Bellas, regarding both individuals and taxa, always in teak plots.
- There was little similarity in floral composition between the four sites visited.
- No tree or shrub individuals were identified in pastureland plots.
- At La Mesa, no indicator species of good habitat quality were found, whereas at the Santa Rita site, nine taxa that are moist forest indicators were recorded.
- The plantation farms in the areas of study are part of the landscape, which in the case of La Mesa, Veraguas, is very degraded, whereas in Santa Rita, Colón it seems to remain natural. On the other hand, all of them are associated with areas of natural regeneration, secondary forests and even slightly altered forests; they also have some habitat configurations that could foster connectivity and enable bird mobility towards other habitats — be it through live fences, riparian forests or mangrove forests.

- All the farms in the areas of study recorded the presence of fruit-eating birds, which include various species of tanagers, thrush, parakeets/parrots, chachalacas and toucans, which is important to guarantee seed dispersal and maintain the regeneration of forests.

7. RECOMMENDATIONS

Based on the data obtained, the following is recommended:

- Increase the number of monitoring plots, without doing more cleaning than what is applied to the rest of the plantation, so that the results can better reflect the condition of the plantation.
- Do another census of the plots in four or five years, to estimate the effect of management during the evolution of natural regeneration that takes place in them.
- Establish monitoring plots, including soil studies in forests without plantations — at least one in Santa Rita and another in Palmas Bellas.
- Create a system for the study of birds in plantations, using methodologies like count points on trails; unify the observation schedule so that it only takes place in the mornings and that the bird counts take place during the breeding season of resident birds (between March and July).

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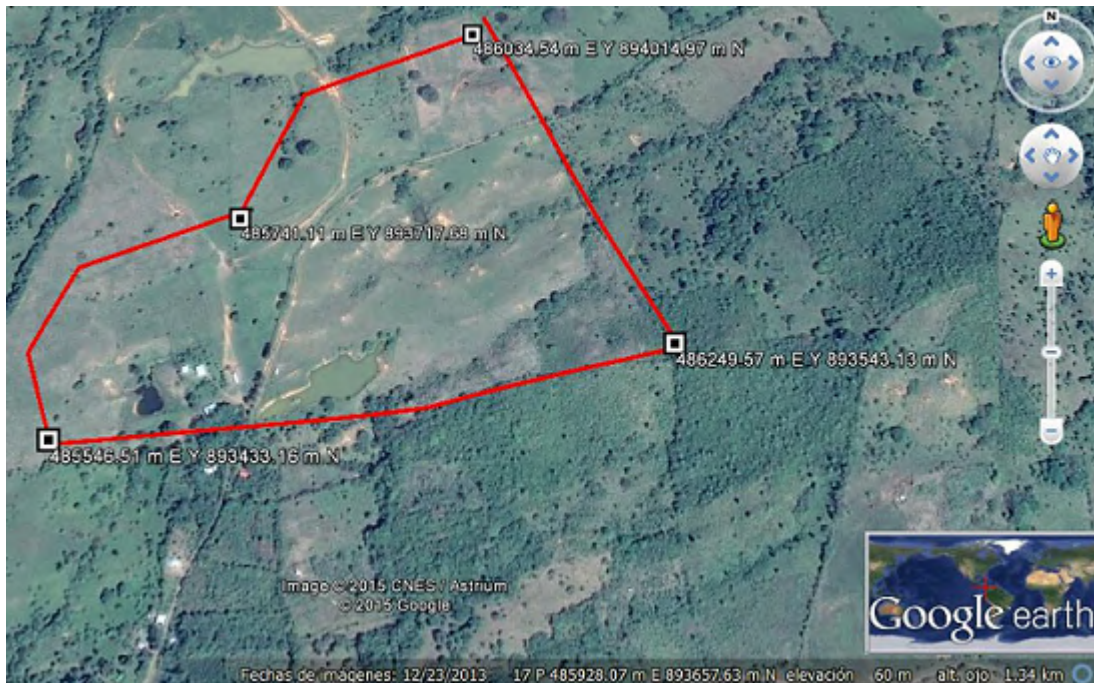
ANNEXES

ANNEX 1. LOCATION OF THE FARMS VISITED DURING THE PROJECT

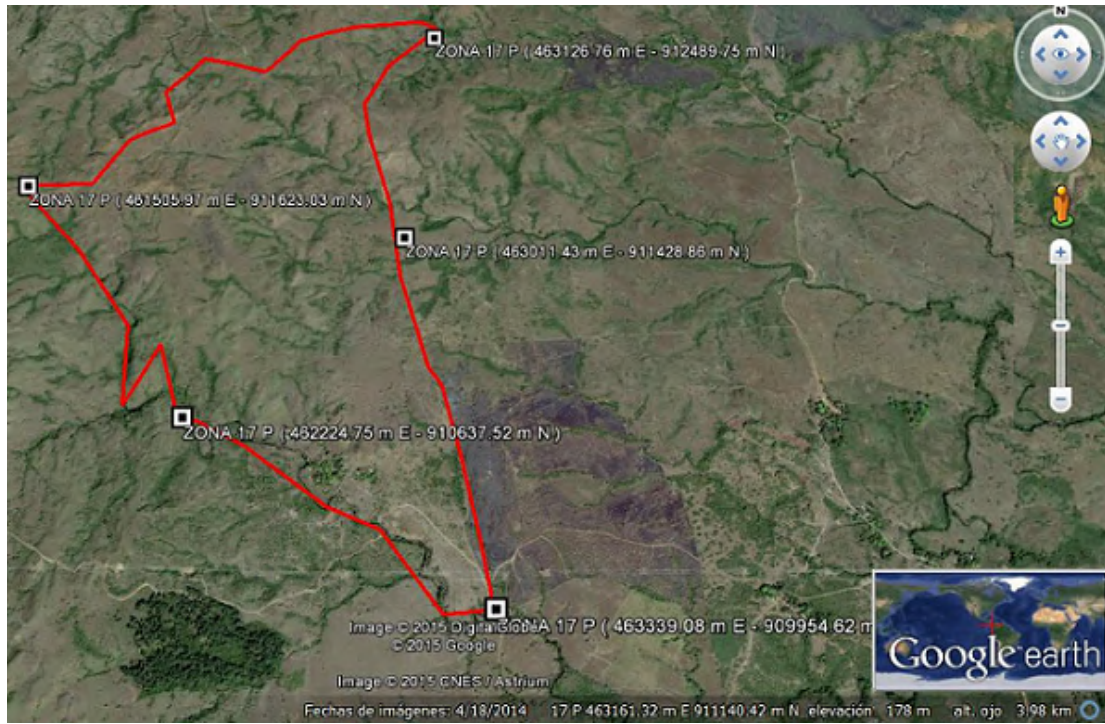
LA MESA, VERAGUAS



Location of the farms in La Mesa, Veraguas.



Manuel Castillo Farm



La Torcaza Farm

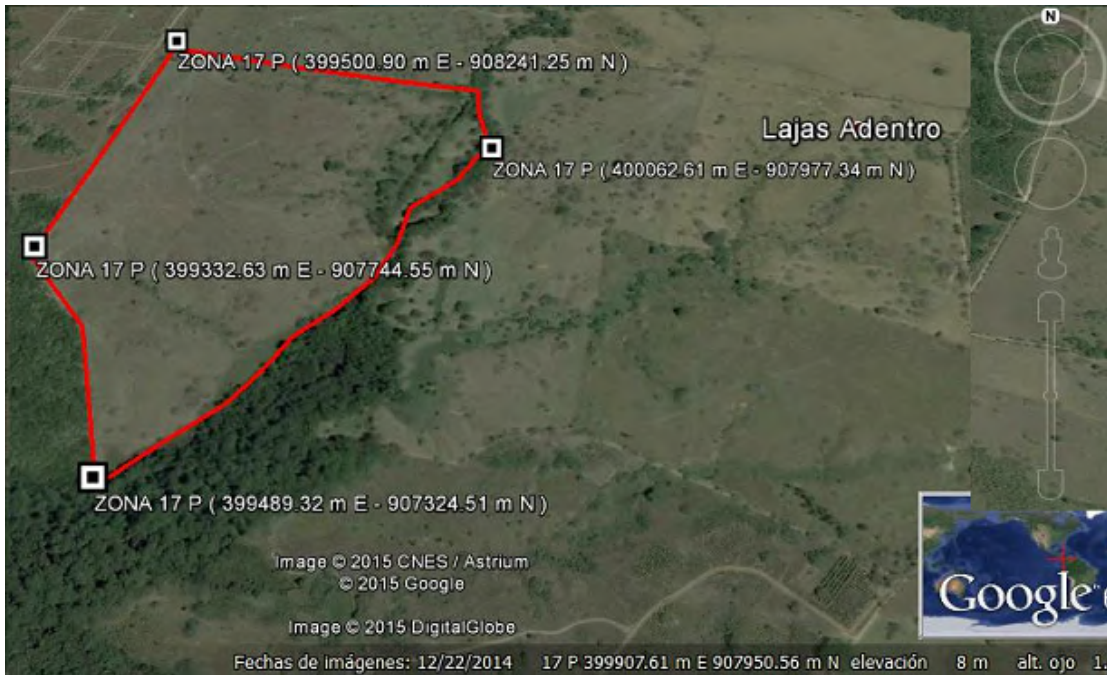


Agustín Mendoza N° 1 Farm

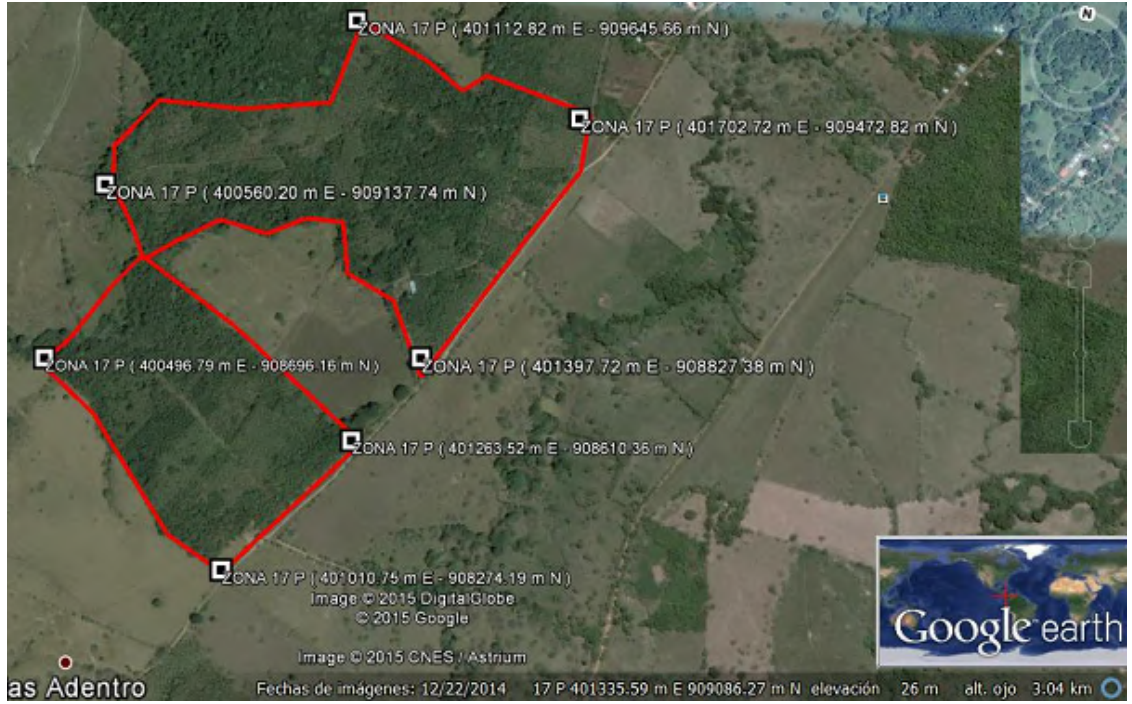
□ LAS LAJAS, CHIRIQUÍ



Location of farms in Las Lajas, Chiriquí.



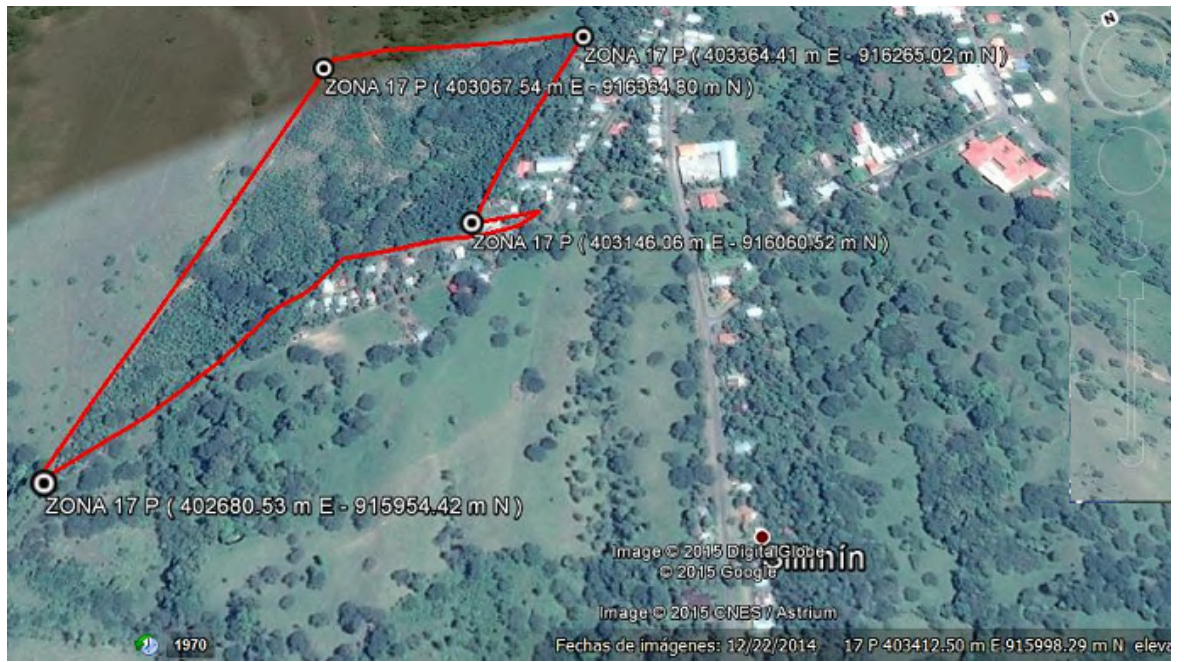
Carrera Farm



Los Ríos Farm



Madera Fina Farm



Silimín Farm

- PALMAS BELLAS, DARIÉN



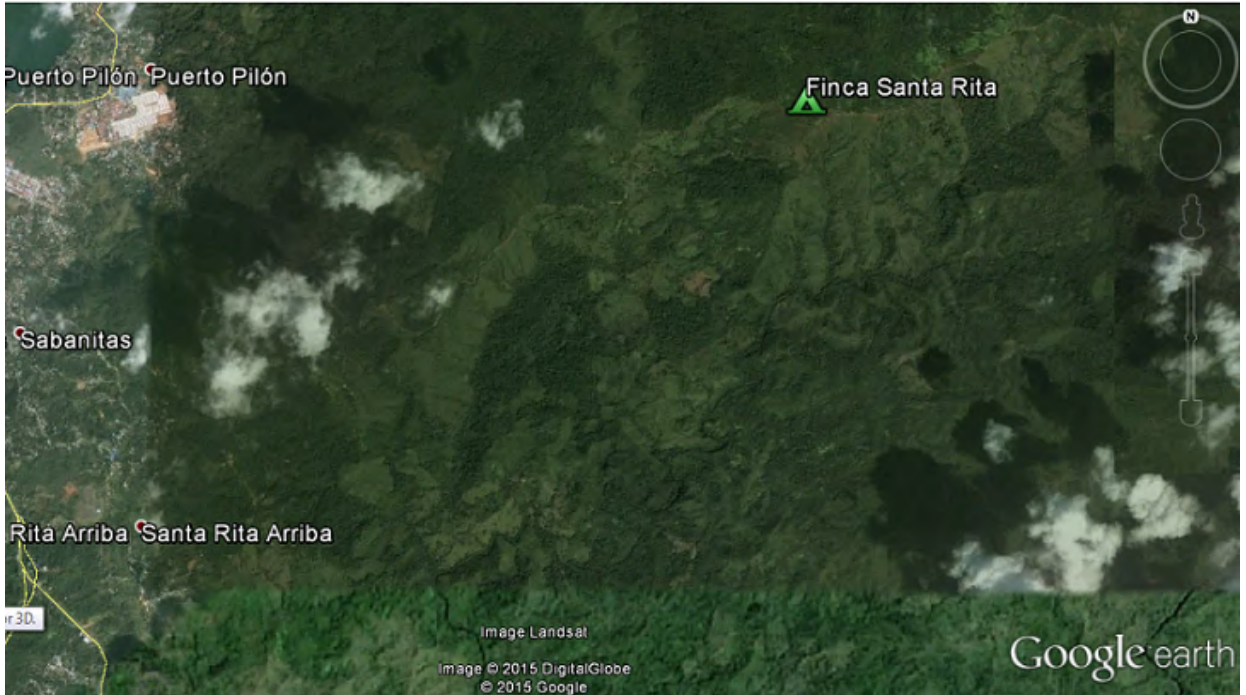
Location of farms in Palmas Bellas, Darién.



La Reina Farm



Kapok Farm



Location of farm in Santa Rita, Colón.



Santa Rita Farm

ANNEX 2. SPECIES REGISTERED IN THE VISITED FARMS

ANNOTATED LIST OF THE FLORA REGISTERED IN VISITED SITES

Name		Common Name	Forestry	Use	La Mesa
MAGNOLIOPSIDA					
Acanthaceae	<i>Aphelandra deppeana</i>	camaroncillo		o	
	<i>Aphelandra</i> sp.	camaroncillo			
	<i>Justicia pectoralis</i>	tilo		r	
Amaranthaceae	<i>Achyranthes aspera</i>	pega pega			
	<i>Alternanthera parochynoides</i>	sanguinaria		r	
	<i>Amaranthus spinosus</i>	bledo		c	
	<i>Chamissoa altissima</i>	..			
	<i>Pleuropetalum</i> sp.	..			
Anacardiaceae	<i>Anacardium excelsum</i>	espavé	p		X
	<i>Anacardium occidentale</i>	marañón	p	a	X
	<i>Astronium graveolens</i>	zorro	e		
	<i>Mangifera indica</i>	mango	p	a	X
	<i>Spondias mombin</i>	jobo		a	X
	<i>Spondias purpurea</i>	plum		a	X
Annonaceae	Annonaceae	..			
	<i>Annona acuminata</i>	anoncito			
	<i>Annona muricata</i>	soursop		a	
	<i>Annona</i> sp.	anón			
	<i>Annona spraguei</i>	anón		c	
	<i>Desmopsis</i> sp.	yayito			
	<i>Guatteria</i> sp.	yaya			
	<i>Unonopsis</i> sp.	yaya			
	<i>Xylopia aromatica</i>	malagueto macho		f	X
	<i>Xylopia frutescens</i>	malagueto hembra		f	

Name		Common Name	Forestry	Use	La Mesa
	<i>Xylopia macrantha</i>	malagueto de montaña			
Apocynaceae	Apocynaceae 1	bejuco			
	Apocynaceae 2	bejuco			
	Asclepiadiodeae 1	bejuco			
	Asclepiadiodeae 2	bejuco			
	<i>Asclepias curassavica</i>	niño muerto		t	
	<i>Aspidosperma</i> sp.	alcarreto	e		
	<i>Fischeria</i> sp.	bejuco			
	<i>Laxoplumeria tessmannii</i>	..			
	<i>Mandevilla hirsuta</i>	bejuco			
	<i>Matelea</i> sp.	bejuco			
	<i>Odontadenia</i> sp.	bejuco			
	<i>Plumeria pudica</i>	caracucha blanca		o	
	<i>Rauvolfia purpurascens</i>	..			
	<i>Stemadennia grandiflora</i>	cojón de gato			
	<i>Stemadennia</i> sp.	huevo de gato			
	<i>Tabernaemontana</i> sp.	huevo de gato			
	<i>Thevetia ahouai</i>	huevo de gato		o	
Araliaceae	<i>Dendropanax arboreus</i>	palomo			
	<i>Eryngium foetidum</i>	culantro		a	
	<i>Schefflera morototoni</i>	mangabé		l	
Aristolochiaceae	<i>Aristolochia</i> sp.1	bejuco			
	<i>Aristolochia</i> sp.2	guaco			
Asteraceae	Asteraceae 1	..			
	Asteraceae 2	bejuco			
	Asteraceae 3	botoncillo			X
	<i>Baltimora recta</i>	sirvulaca		l	

Name	Common Name	Forestry	Use	La Mesa	
	<i>Chaptalia nutans</i>	diente de león		r	
	<i>Chromolaena odorata</i>	hierba de chiva			X
	<i>Emilia sonchifolia</i>	brujita			
	<i>Erechtites sp.</i>	brujita			
	<i>Fleischmannia sp.</i>	..			
	<i>Lycoseris triplinerve</i>	bejuco			
	<i>Melampodium divaricatum</i>	sirvulaca			
	<i>Mikania sp.1</i>	guaco			
	<i>Mikania sp.2</i>	guaco			
	<i>Pseudelephantopus spicatus</i>	chicoria		r	
	<i>Sphagneticola trilobata</i>	clavellín de playa		r	
	<i>Spilanthes sp.</i>				
	<i>Tridax procumbens</i>	hierba del toro			
	<i>Vernonanthura patens</i>	lengua de buey		l	X
	<i>Wulffia baccata</i>	bejuco			
Bignoniaceae	Bignoniaceae 1	bejuco			
	Bignoniaceae 2	bejuco			
	Bignoniaceae 3	bejuco			
	<i>Godmania aesculifolia</i>				X
	<i>Jacaranda caucana</i>	nazareno	f	o	X
	<i>Jacaranda copaia</i>	palo de buba		o	
	<i>Macfadyena unguis-cati</i>	uña de gato			
	<i>Parmentiera sp.</i>				
	<i>Tabebuia guayacan</i>	Guayacan	p		X
	<i>Tabebuia ochracea</i>	Guayacan	p	o	X
	<i>Tabebuia rosea</i>	roble de sabana	p		X
Bixaceae	<i>Bixa orellana</i>	achiote		a	X

Name		Common Name	Forestry	Use	La Mesa
Boraginaceae	<i>Cordia alliodora</i>	laurel	p		X
	<i>Cordia bicolor</i>	muñeco	f		
	<i>Cordia collococca</i>	muñeco	f		
	<i>Cordia cymosa</i>	laurel negro			
	<i>Cordia panamensis</i>	muñeco	f		
	<i>Cordia porcata</i>				
Burseraceae	<i>Bursera simaruba</i>	cholo pelao		v	X
	<i>Bursera tomentosa</i>	carate blanco		v	X
	<i>Protium panamense</i>	chutr�			
Cactaceae	<i>Epiphyllum phyllanthus</i>	cactus		o	
	<i>Hylocereus</i> sp.	cactus			
Cannabaceae	<i>Celtis schippii</i>				
Capparaceae	<i>Capparis discolor</i>				
	<i>Capparis frondosa</i>	garrotillo			
	<i>Cleome</i> sp.				
Caricaceae	<i>Carica papaya</i>	papaya		a	
	<i>Jacaratia spinosa</i>	papyuelo		c	
Chloranthaceae	<i>Hedyosmum</i> sp.	sauquillo			
Chrysobalanaceae	<i>Chrysobalanaceae</i>	..			
	<i>Chrysobalanus icaco</i>	icaco		c	
	<i>Hirtella americana</i>	garrapato			
	<i>Hirtella racemosa</i>	garrapato			
	<i>Hirtella triandra</i>	garrapato			
	<i>Licania arborea</i>	raspa			
	<i>Licania hypoleuca</i>	garrapato			
Clusiaceae	Clusiaceae	..			
	<i>Calophyllum brasiliense</i>	mar�a	e		

Name		Common Name	Forestry	Use	La Mesa
	<i>Calophyllum longifolium</i>	maría	e		
	<i>Chrysochlamys</i> sp.	..			
	<i>Clusia</i> sp.1	copé			
	<i>Clusia</i> sp.2	copé			X
	<i>Garcinia</i> sp.	fruta de mono		c	
	<i>Marila laxiflora</i>	..			
	<i>Marila</i> sp.	..			
	<i>Symphonia globulifera</i>	cerillo	e		
	<i>Tovomita stylosa</i>	..			
	<i>Vismia baccifera</i>	pinta mozo, carachero		r	X
	<i>Vismia macrophylla</i>	pinta mozo		r	
Cochlospermaceae	<i>Cochlospermum orinocense</i>	porotuirá			
	<i>Cochlospermum vitifolium</i>	poro poro		v	
Combretaceae	<i>Combretum</i> sp.	mostrenco			
	<i>Terminalia amazonia</i>	yellow cedar	p		X
	<i>Terminalia oblonga</i>	guayabilllo	f		
Connaraceae	<i>Rourea glabra</i>	mata negro		t	
Convolvulaceae	Covolvulaceae	batatilla			
	<i>Evolvulus numularius</i>	¿-			
	<i>Ipomoea</i> sp. 1	batatilla			
	<i>Ipomoea</i> sp. 2	batatilla			
	<i>Merremia</i> sp.	trompito			
Cucurbitaceae	Cucurbitaceae 1	bejuco			
	Cucurbitaceae 2	bejuco			
	Cucurbitaceae 3				
	<i>Gurania</i> sp.	ya te vi			
	<i>Melothria</i> sp.	sandillita			

Name		Common Name	Forestry	Use	La Mesa
	<i>Momordica charantia</i>	balsamino		r	
	<i>Psiguria</i> sp.	bejuco			
Dilleniaceae	<i>Curatella americana</i>	chumico		o	X
	<i>Davilla kunthi</i>	chumiquillo			X
	<i>Tetracera</i> sp.	chumiquillo			
	<i>Tetracera volubiilis</i>	chumiquillo			
Elaeocarpaceae	<i>Sloanea</i> sp.	terciopelo			
Erythroxylaceae	<i>Erythroxylum</i> sp.1	alcarreto			
	<i>Erythroxylum</i> sp.2	alcarreto			
Euphorbiaceae	<i>Alchornea latifolia</i>	achotillo			
	<i>Caperonia</i> sp.	..			X
	<i>Cnidoscolus urens</i>	ortiga		t	
	<i>Croton</i> sp.				
	<i>Croton trinitatis</i>				
	<i>Euphorbia heterophylla</i>	pastro de monte			
	<i>Euphorbia hyssopifolia</i>	hierba de pollo			
	<i>Hieronyma alchorneoides</i>	zapater			X
	<i>Jatropha curcas</i>	higuerilla		v	
	<i>Mabea occidentalis</i>	..			
	<i>Manihot esculenta</i>	yuca		a	
	<i>Pera arborea</i>	sapito			
	<i>Sapium glandulosum</i>	Olivo	f		X
Fabaceae	Fabaceae 1	..			
	Fabaceae 2	bejuco			
	<i>Acacia melanoceras</i>	cachito			
	<i>Acacia</i> sp.	bejuco			
	<i>Albizia niopoides</i>	fijolillo	f		

Name	Common Name	Forestry	Use	La Mesa
<i>Alysicarpus vaginalis</i>				X
<i>Andira inermis</i>	harino	f	v	X
<i>Bauhinia guianensis</i>	escalera de mono			
<i>Brownea macrophylla</i>	rosa de monte		o	
<i>Cajanus bicolor</i>	guandú		a	
<i>Calopogonium phaseoloides</i>	/			X
<i>Calopogonium sp.</i>				
<i>Cassia moschata</i>	Golden shower tree	c, p	o	X
<i>Cojoba rufescens</i>	coralillo		o	
<i>Copaifera aromatica</i>	cabimo	p		
<i>Crotalaria pilosa</i>	frijolillo			X
<i>Dalbergia retusa</i>	Cocobolo Rosewood	p		X
<i>Desmodium cajanifolium</i>	pega pega			
<i>Desmodium sp.</i>	pega pega			
<i>Diphysa americana</i>	Macan	f		X
<i>Dipteryx oleifera</i>	almendro de montaña	p		
<i>Entada gigas</i>	..			
<i>Enterlobium cyclocarpum</i>	corotú	p		X
<i>Enterolobium schomburgkii</i>	jarina	f		
<i>Erythrina costaricensis</i>	pito		v	
<i>Erythrina rubrinervia</i>	pito		v	X
<i>Flemingia strobilifera</i>	..		x	
<i>Gliricidia sepium</i>	Balo		v	X
<i>Hymenaea couribaril</i>	algarrobo	f		X
<i>Inga sp. 1</i>	guabo		c	
<i>Inga sp. 2</i>	guabo		c	
<i>Inga sp. 3</i>	guabo		c	

Name		Common Name	Forestry	Use	La Mesa
	<i>Inga</i> sp. 4	guabo		c	
	<i>Inga</i> sp. 5	guabo		c	
	<i>Inga</i> sp. 6	guabo		c	
	<i>Inga</i> sp. 7	guabo		c	
	<i>Inga</i> sp. 8	guabo		c	
	<i>Inga</i> sp. 9	guabo		c	
	<i>Inga laurina</i>	guabo		c	
	<i>Inga cocleensis</i>	guabo		c	
	<i>Inga spectabilis</i>	guabo		a	X
	<i>Lonchocarpus</i> sp.	cucaracho			X
	<i>Machaerium</i> sp.	bejuco			
	<i>Mimosa debilis</i>	dormidera			
	<i>Mimosa pudica</i>	dormidera			
	<i>Ormosia</i> sp.	frijolillo			
	<i>Peltogyne purpurea</i>	nazareno	f		
	<i>Pithecellobium</i> sp.	..			
	<i>Pithecellobium hymenaeifolium</i>	espino de vaca			
	<i>Platymiscium pinnatum</i>	quirá	f		
	<i>Pseudosamanea guachapele</i>	guachapalí	p		X
	<i>Rhynchosia</i> sp.	bejuco			
	<i>Senna dariensis</i>	..			
	<i>Senna reticulata</i>	laureño		r	
	<i>Senna</i> sp.	..		r	
	<i>Swartzia simplex</i>	naranjito			
	<i>Tachigali versicolor</i>	suicida			
	<i>Tamarindus indica</i>	tamarindo		a	
	<i>Tephrosia</i> sp.	bejuco			

Name	Common Name	Forestry	Use	La Mesa
	<i>Vatairea erythrocarpa</i>	amargo amargo	f	
	<i>Vigna</i> sp.	frijolito		
Gentianaceae	<i>Chelonanthus alatus</i>	árbol de adán		
	<i>Coutoubea spicata</i>	¿-		X
	<i>Voyria</i> sp.	..		
Gesneriaceae	<i>Chrysothemis pulchella</i>	siria	o	
	<i>Codonanthe</i> sp.	..		
	<i>Drymonia</i> sp.	..		
Lacistemataceae	<i>Lacistema aggregatum</i>	cafecillo		
Lamiaceae	Lamiaceae	..		
	Lamiaceae	..		
	<i>Callicarpa acuminata</i>	no te conozco		
	<i>Hyptis capitata</i>	suspiro de monte		X
	<i>Hyptis</i> sp.	suspiro de monte		
	<i>Lippia</i> sp.	..	r	
	<i>Tectona grandis</i>	teak	p	X
Lauraceae	Lauraceae	sigua		
	Lauraceae 2	sigua		
	Lauraceae 3	..		
	<i>Cinnamomum</i> sp.	sigua		
	<i>Nectandra cuspidata</i>	sigua		
	<i>Ocotea</i> cf. <i>linearis</i>	sigua		
	<i>Ocotea</i> sp.	sigua		
	<i>Ocotea</i> sp.2	sigua		
	<i>Ocotea</i> sp.3	sigua		
	<i>Persea americana</i>	avocado	a	
Lecythidaceae	<i>Eschweilera</i> sp. 1	ollito		

Name	Common Name	Forestry	Use	La Mesa	
	<i>Eschweilera</i> sp. 2	ollito			
	<i>Gustavia</i> sp.	membrillo			
	<i>Gustavia superba</i>	membrillo	c		
Loganiaceae	<i>Spigelia anthermia</i>	lombricera	r		
	<i>Strychnos</i> sp. 1	bejuco	t		
	<i>Strychnos</i> sp.	bejuco	t		
Loranthaceae	Loranthaceae 1	matapalo			
	Loranthaceae2	matapalo			
Lythraceae	<i>Cuphea</i> sp.	cielito		X	
	<i>Cuphea utriculosa</i>	s/n	o	X	
Magnoliaceae	<i>Talauma</i> sp.	baco			
Malpighiaceae	Malpighiaceae	bejuco		X	
	Malpighiaceae 2	bejuco			
	<i>Stigmaphyllon</i> sp.	bejuco			
	<i>Byrsonima crassifolia</i>	Nance	e, p	a	X
Malvaceae	<i>Apeiba membranacea</i>	cortezo		f	
	<i>Apeiba tibourbou</i>	cortezo		f	X
	<i>Cavanillesia platanifolia</i>	Cuipo			
	<i>Ceiba pentandra</i>	cottonwood tree			
	<i>Corchorus siliquosus</i>	escobilla			
	<i>Guazuma ulmifolia</i>	West Indian Elm		v	X
	<i>Hampea appendiculata</i>	azote			
	<i>Helicteres guazumifolia</i>	guácimo molenillo			X
	<i>Herrania purpurea</i>	cacaito de monte		c	
	<i>Hibiscus</i> sp.	papo de monte			
	<i>Hibiscus rosa-sinensis</i>	papo		o	X
	<i>Luehea seemanii</i>	guácimo colorado			

Name		Common Name	Forestry	Use	La Mesa
	<i>Malachra alceifolia</i>	malva			
	<i>Malachra</i> sp.	malva			
	<i>Ochroma pyramidale</i>	balso			X
	<i>Pachira quinata</i>	spiny cedar			X
	<i>Pachira sessilis</i>	yuco de monte			
	<i>Pseudobombax septenatum</i>	barrigón			
	<i>Quararibea</i> sp.1				
	<i>Quararibea</i> sp.2	molenillo			
	<i>Sida acuta</i>	escobilla			X
	<i>Sida linifolia</i>	..			
	<i>Sida</i> sp.	escobilla			
	<i>Sterculia apetala</i>	panamá			
	<i>Theobroma cacao</i>	cacao		a	
	<i>Urena lobata</i>	cepa de caballo			
	<i>Waltheria glomerata</i>	guacimillo			X
	<i>Waltheria</i> sp.	guacimillo			
	<i>Wissadula excelsior</i>				X
Melastomataceae	Melastomataceae 1	canillo			
	Melastomataceae 2				
	Melastomataceae 3				
	Melastomataceae4				X
	<i>Bellucia pentamera</i>	coronillo			
	<i>Clidemia octona</i>	canillo			
	<i>Conostegia cinnamomea</i>	canillo			
	<i>Miconia affinis</i>	canillo			
	<i>Miconia argentea</i>	dos caras			X
	<i>Miconia impetolaris</i>	oreja de mula			X

Name	Common Name	Forestry	Use	La Mesa
	<i>Miconia lacera</i>	canillo		
	<i>Miconia pubescnte</i>	canillo		
	<i>Miconia</i> sp.1	canillo		
	<i>Miconia</i> sp.2			
	<i>Rhynchanthera grandiflora</i>	uña del diablo		X
Meliaceae	<i>Cedrela odorata</i>	cedro amargo	f	
	<i>Guarea</i> sp.	cedro macho	f	
	<i>Khaya</i> sp.	mahogany africana	f	X
	<i>Swietenia macrophylla</i>	mahogany	e, p	
	<i>Trichilia hirta</i>	conejo colorado		
	<i>Trichilia pallida</i>	terciopelo		
	<i>Trichilia</i> sp.			
Menispermaceae	<i>Abuta</i> sp.	bejuco		
Monimiaceae	<i>Mollinedia</i> sp.	pasmo		
	<i>Brosimum alicastrum</i>	berbá	e	
	<i>Brosimum</i> sp.	sande		
	<i>Castilla elastica</i>	caucho		
	<i>Ficus insipida</i>	higuerón		
	<i>Ficus kurzii</i>	ficus		X
	<i>Ficus</i> sp.1	higo		
	<i>Ficus</i> sp.2	matapalo		
	<i>Ficus</i> sp.3	matapalo		X
	<i>Maclura tinctoria</i>	mora	e	
	<i>Maquira guianensis</i>	palo de pico		
	<i>Pseudolmedia</i> sp.	..		
	<i>Sorocea affinis</i>	cauchillo		
Myristicaceae	<i>Myristicaceae</i>	miguelario		

Name		Common Name	Forestry	Use	La Mesa
	<i>Otoba</i> sp.	miguelario			
	<i>Virola sebifera</i>	miguelario	e		
	<i>Virola</i> sp. 1	miguelario			
	<i>Virola</i> sp 2	miguelario			
Myrtaceae	Myrtaceae	..			
	<i>Eugenia oerstediana</i>	guayabito de montaña		c	
	<i>Eugenia principium</i>	arraiján			X
	<i>Eugenia</i> sp. 1	guayabillo			
	<i>Eugenia</i> sp. 2	guayabillo			
	<i>Eugenia</i> sp. 3	guayabillo			
	<i>Eugenia</i> sp. 4	guayabillo			
	<i>Eugenia</i> sp. 5	guayabillo			
	<i>Myrciaria</i> sp.			c	
	<i>Psidium guajava</i>	guayaba		a	X
	<i>Psidium guineense</i>	guayaba de monte		a	X
	<i>Syzygium jambos</i>	pomarrosa		a	
	<i>Syzygium malaccense</i>	marañón curazao		a	X
Nyctaginaceae	<i>Bougainvillia glabra</i>	veranera		o	X
	<i>Neea</i> sp.	..			
Ochnaceae	<i>Cespedezia spathulata</i>	membrillo macho			
	<i>Ouratea lucens</i>				
	<i>Ouratea</i> sp.	..			
	<i>Sauvagesia erecta</i>	..			
Onagraceae	<i>Ludwigia</i> sp.	..			
Oxalidaceae	<i>Biophytum</i> sp.	..			
Passifloraceae	<i>Passiflora</i> sp.	guate		c	
	<i>Passiflora</i> sp.2	bejuco			

Name		Common Name	Forestry	Use	La Mesa
	<i>Passiflora vitifolia</i>	guate		c	
Phyllanthaceae	<i>Phyllanthus niruri</i>	hierba			
Picramniaceae	<i>Picramnia gracilis</i>	canjura			
Piperaceae	<i>Peperomia pellucida</i>	hierba de sapo		r	
	<i>Piper marginatum</i>	hinojo		r	
	<i>Piper peltatum</i>	hinojo		r	
Piperaceae	<i>Piper reticulatum</i>	hinojo			
	<i>Piper sp.1</i>	hinojo			
	<i>Piper sp.2</i>	hinojo			
	<i>Piper sp.3</i>	gusanillo			
	<i>Piper tuberculatum</i>	gusanillo			
Polygalaceae	<i>Polygala longicaulis</i>				X
	<i>Polygala sp.</i>	..			
	<i>Securidaca diversifolia</i>	bejuco mulato			
Polygonaceae	<i>Coccoloba caracasana</i>	maquenca			
	<i>Coccoloba sp.</i>	maquenque			
	<i>Triplaris cumingiana</i>	vara santa			
Portulacaceae	<i>Portulaca oleracea</i>	verdolaga		c	
Primulaceae	<i>Ardisia sp.</i>	..			
	<i>Stylogyne sp.</i>	..			
Proteaceae	<i>Roupala montana</i>	carne asada			X
Rhamnaceae	<i>Colubrina glandulosa</i>	frío			X
	<i>Gouania lupuloides</i>	bejuco			
Rubiaceae	Rubiaceae	..			
	<i>Alibertia edulis</i>	trompito		c	X
	<i>Appunia seibertii</i>	madroño			
	<i>Borreria latifolia</i>	cansa peón			X

Name		Common Name	Forestry	Use	La Mesa
	<i>Borreria</i> sp.	-			
	<i>Calicophyllum candidissimum</i>	madroño		o	
	<i>Chiococca alba</i>	bejuco			
	<i>Chomelia spinosa</i>	espino			X
	<i>Coccosypelum</i> sp.	..			
	<i>Cosmibuena grandiflora</i>	tabaquillo			
	<i>Declieuxia fruticosa</i>	..			X
	<i>Faramea occidentalis</i>	huesito			
	<i>Genipa americana</i>	Marmalade box		c	X
	<i>Guettarda</i> sp.				
	<i>Guettarda foliacea</i>	espino amarillo			
	<i>Hamelia patens</i>	uvero		c	
	<i>Isertia haenkeana</i>	canelito		o	
	<i>Isertia laevis</i>	canelito			
	<i>Morinda citrifolia</i>	noni		r	X
	<i>Neurolaena lobata</i>	contragavilana		r	
	<i>Oldenlandia callitrichoides</i>	hierba de cui			
	<i>Oldenlandia corymbosa</i>	pajita			
	<i>Palicourea guianensis</i>	recadito			
	<i>Palicourea triphylla</i>	..			
	<i>Posoqueria latifolia</i>	boca vieja		c	
	<i>Psychotria acuminata</i>	cafecillo			
	<i>Psychotria elata</i>	labios ardientes			
	<i>Psychotria glomerulata</i>	labios blancos			
	<i>Psychotria horizontalis</i>	cafecillo			
	<i>Psychotria nervosa</i>	cafecillo			
	<i>Psychotria poeppigiana</i>	labios ardientes			

Name	Common Name	Forestry	Use	La Mesa
	<i>Psychotria</i> sp.	cafecillo		
	<i>Randia armata</i>	miel quemá	c	
	<i>Sabicea villosa</i>	bejuco		
	<i>Schradera</i> sp.	bejuco		
Rutaceae	<i>Citrus aurantiifolia</i>	lemon	a	
	<i>Citrus aurantium</i>	sour orange	a	
	<i>Citrus sinensis</i>	orange	a	
	<i>Zanthoxylum acuminatum</i>	arcabú	e	
	<i>Zanthoxylum ekmanii</i>	arcabú	e	
	<i>Zanthoxylum setulosum</i>	arcabú	e	
	<i>Zanthoxylum</i> sp.	arcabú	e	
Sabiaceae	<i>Meliosma</i> sp.	..		
Salicaceae	<i>Banara guianensis</i>	raspa lengua		
	<i>Casearia aculeata</i>	pica lengua		
	<i>Casearia arborea</i>	raspa lengua		
	<i>Casearia guianensis</i>	raspa lengua		X
	<i>Casearia</i> sp.	raspa lengua		
	<i>Ryania speciosa</i>	corta lengua		
	<i>Zuelania guidonia</i>	cagajón		
Sapindaceae	<i>Alophylus</i> sp.	estiquillo		
	<i>Cupania latifolia</i>	gorgojo		
	<i>Cupania rufescens</i>	gorgojo		
	<i>Cupania</i> sp.	gorgojo		
	<i>Cupania sylvatica</i>	gorgojo		
	<i>Dilodendron costaricense</i>	jarino		
	<i>Matayba scrobiculata</i>	matillo	f	X
	<i>Paullinia</i> sp. 1	bejuco		

Name		Common Name	Forestry	Use	La Mesa
	<i>Paullinia</i> sp. 2	¿--			
	<i>Serjania</i> sp.	bejuco			
	<i>Talisia nervosa</i>	mamón de montaña			
Sapotaceae	Sapotaceae	..			
	<i>Chrysophyllum cainito</i>	caimito	f	a	X
	<i>Manilkara bidentata</i>	níspero	p		
	<i>Manilkara zapota</i>	níspero	f	a	
	<i>Micropholis</i> sp.	..	f		
	<i>Pouteria</i> sp.	sapote	f		
Scrophulariaceae	<i>Linderna crustacea</i>	canjura de tierra			
	<i>Scoparia dulcis</i>	escobilla amarga		r	
Simaroubaceae	<i>Simarouba amara</i>	aceituno		r	
Siparunaceae	<i>Siparuna guianensis</i>	pasmo		r	
	<i>Siparuna</i> sp. 1	pasmo			
	<i>Siparuna</i> sp. 2	pasmo			
Solanaceae	Solanaceae	friega plato			
	<i>Capsicum frutescens</i>	ají picante		a	
	<i>Cestrum</i> sp.	galán de noche			
	<i>Physalis</i> sp.	..			
	<i>Solanum asperum</i>	..			
	<i>Solanum aturense</i>	araña gato			
	<i>Solanum jamaicense</i>	friega plato			
	<i>Solanum lanceifolium</i>	araña gato			
	<i>Solanum rudepannum</i>	araña gato			
	<i>Solanum</i> sp.	friega plato			
Theophrastaceae	<i>Clavija</i> sp.1	..			
	<i>Clavija</i> sp.2	..			

Name		Common Name	Forestry	Use	La Mesa
Ulmaceae	<i>Trema micrantha</i>	jordán			
Urticaceae	<i>Cecropia insignis</i>	Trumpet tree			
	<i>Cecropia longipes</i>	Trumpet tree			
	<i>Cecropia peltata</i>	Trumpet tree			X
	<i>Laportea aestuans</i>	nettle		t	
	<i>Myriocarpa longipes</i>	nettle			
	<i>Pouzolzia obliqua</i>	nettle			
	<i>Urera baccifera</i>	nettle		t	
	<i>Urera caracasana</i>	nettle		t	
Verbenaceae	<i>Aegiphila</i> sp.	bejuco			
	<i>Lantana camara</i>	cinco negritos		o	X
	<i>Petrea volubilis</i>	flor de mayo		o	
	<i>Priva lappulacea</i>	pega pega			
	<i>Stachytarpheta jamaicensis</i>	verbena		o	
	<i>Stachytarpheta</i> sp.	verbena			
Violaceae	<i>Rinorea</i> sp.	..			
Vitaceae	<i>Cissus erosa</i>	bejuco de agua			
	<i>Cissus</i> sp.				
	<i>Cissus verticillata</i>	bejuco			
	<i>Vitis tiliifolia</i>	uvita			
Vochysiaceae	<i>Vochysia ferruginea</i>	mayo			
Amaryllidaceae	<i>Hymenocallis pedalis</i>	lirio		o	
Araceae	<i>Anthurium ochranthum</i>	anturio			
	<i>Anthurium</i> sp.	anturio			
	<i>Caladium bicolor</i>	corazón de Jesús		o	
	<i>Dieffenbachia longispatha</i>	otoe lagarto		t	
	<i>Dieffenbachia oerstedii</i>	caña muda		t	

Name		Common Name	Forestry	Use	La Mesa
	<i>Monstera</i> sp. 1	escudo roto			
	<i>Monstera</i> sp. 2	monstera			
	<i>Philodendron fragrans</i>	filodendro			
	<i>Philodendron radiatum</i>	filodendro			
	<i>Philodendron</i> sp.1	filodendro			
	<i>Philodendron</i> sp.2	filodendro			
	<i>Philodendron</i> sp.3	filodendro			
	<i>Syngonium</i> sp.	singonio			
	<i>Xanthosoma mexicanum</i>	otó			
Arecaceae	<i>Acrocomia aculeata</i>	corozo, pacora		c	X
	<i>Astrocaryum alatum</i>	coquito			
	<i>Astrocaryum standleyannum</i>	chunga		f	
	<i>Attalea butyracea</i>	palma real		f	
	<i>Attalea</i> sp.	palma			
	<i>Bactris gasipaes</i>	pixbae		a	X
	<i>Bactris major</i>	caña brava		c	
	<i>Bactris</i> sp.	pixbae			
	<i>Cocos nucifera</i>	coconut		a	X
	<i>Desmoncus orthacanthos</i>	matamba			
	<i>Elaeis oleifera</i>	corocita		c	
	<i>Euterpe precatoria</i>	palmito		c	
	<i>Geonoma</i> sp.	palma			
	<i>Oenocarpus mapora</i>	maquenque		f	
	<i>Sabal mauritiformis</i>	guágara		f	
	<i>Welfia regia</i>	conga			
Bromeliaceae	<i>Aechmea magdalenae</i>	pita		f	
	<i>Aechmea</i> sp.	bromelia			

Name		Common Name	Forestry	Use	La Mesa
	<i>Guzmania musaica</i>	bromelia		o	
	<i>Guzmania</i> sp.	bromelia			
	<i>Tillandsia bulbosa</i>	bromelia		o	
	<i>Vriesea</i> sp.	bromelia			
Commelinaceae	<i>Commelina</i> sp.	codillo			
	<i>Tripogandra serrulata</i>	hierba			
Costaceae	<i>Costus pulverulentus</i>	caña agria			
	<i>Costus</i> sp.	caña agria		r	X
Cyclanthaceae	<i>Carludovica palmata</i>	nawala		f	
	<i>Cyclanthus bipartitus</i>	lengua de buey			
Cyperaceae	Cyperaceae	paja			
	<i>Cyperus</i> sp. 1	paja			
	<i>Cyperus</i> sp. 2	paja			
	<i>Cyperus</i> sp. 3	paja			
	<i>Cyperus</i> sp. 4	paja			
	<i>Hypolytrum longifolium</i>	..			
	<i>Kyllinga odorata</i>	paja			
	<i>Mapania assimilis</i>	paja			
	<i>Rhynchospora cephalotes</i>				
	<i>Rhynchospora nervosa</i>	paja			X
	<i>Rhynchospora</i> sp.	paja			
	<i>Scleria secans</i>	cortadera			
	<i>Scleria</i> sp.	cortadera			
Dioscoreaceae	<i>Dioscorea</i> sp.	ñame de monte			
Haemodoraceae	<i>Xiphidium caeruleum</i>	mano de dios			
Heliconiaceae	<i>Heliconia irrasa</i>	platanilla		o	
	<i>Heliconia longiflora</i>	platanilla		o	

Name		Common Name	Forestry	Use	La Mesa
	<i>Heliconia mariae</i>	platanilla		o	
	<i>Heliconia metallica</i>	platanilla		o	
	<i>Heliconia platystachys</i>	platanilla		o	
	<i>Heliconia psittacorum x spathocircinata</i>	helyconia		o	X
	<i>Heliconia rostrata</i>	platanilla		o	X
	<i>Heliconia</i> sp.	platanilla			
Marantaceae	<i>Calathea crotalifera</i>	bijao		f	
	<i>Calathea panamensis</i>	bijao		f	
	<i>Calathea</i> sp.	bijao			
	<i>Pleiostachya</i> sp.	..			
	<i>Stromanthe jacquinii</i>	montaña, platanilla de			
Musaceae	<i>Musa balbisiana x acuminata</i>	plátano		a	X
Orchidaceae	<i>Catasetum</i> sp. 1	orchid		o	
	<i>Catasetum</i> sp. 2	orchid		o	
	<i>Catasetum viridiflavum</i>	orchid		o	
	<i>Dichaea</i> sp.	orchid			
	<i>Dimerandra stenopetala</i>	orchid		o	
	<i>Encyclia cordigera</i>	orchid		o	X
	<i>Encyclia</i> sp. 1	orchid			
	<i>Encyclia</i> sp. 2	orchid			
	<i>Epidendrum difforme</i>	orchid			
	<i>Epidendrum nocturnum</i>	orchid		o	
	<i>Epidendrum</i> sp.	orchid			
	<i>Epidendrum</i> sp.2	orchid			
	<i>Epidendrum stamfordianum</i>	orchid		o	
	<i>Habenaria</i> sp.	orchid			
	<i>Maxillaria camaridii</i>	orchid		o	X

Name		Common Name	Forestry	Use	La Mesa
	<i>Maxillaria</i> sp.	orchid			
	<i>Oeceoclades maculata</i>	orchid		o	
	<i>Peristeria elata</i>	flor del espíritu santo		o	
	<i>Polystachya foliosa</i>	orchid			
	<i>Scaphyglottis bidentata</i>	orchid		o	
	<i>Scaphyglottis</i> sp.	orchid			
	<i>Sobralia fragrans</i>	orchid		o	
	<i>Sobralia macrophylla</i>	orchid		o	
	<i>Spatoglottis plicata</i>	orchid		o	
	<i>Vanilla</i> sp.	vanilla		c	
Poaceae	Poaceae	Pasto			
	<i>Andropogon fastigiatus</i>	paja			
	<i>Andropogon</i> sp. 1	rabo de venao			
	<i>Andropogon</i> sp.2	rabo de vanado			X
	<i>Aristida capillacea</i>	pajita del niño dios			
	<i>Bothriochloa bladhii</i>	paja		p	X
	<i>Brachiaria humidicola</i>	humidícola		p	
	<i>Brachiaria</i> sp.	pasto mejorado		p	X
	<i>Chloris</i> sp.	paja			
	<i>Chusquea simpliciflora</i>	carricillo			
	<i>Cynodon dactylon</i>	pasto bermuda			
	<i>Digitaria</i> sp.	paja			
	<i>Echinochloa colona</i>	arrocillo			
	<i>Eleusine indica</i>	pata de gallina			
	<i>Hyparrhenia rufa</i>	faragua		p	X
	<i>Ischaemum indicum</i>	ratana		p	
	<i>Olyra latifolia</i>	paja			

Name		Common Name	Forestry	Use	La Mesa
	<i>Oplismenus</i> sp.	paja			
	<i>Oriza sativa</i>	rice		a	
	<i>Orthoclada laxa</i>	paja			
	<i>Panicum grande</i>	paja		p	
	<i>Panicum maximum</i>	pasto elefante		p	X
	<i>Paspalum notatum</i>	paja de llano		p	X
	<i>Paspalum plicatulum</i>	cabezona		p	X
	<i>Paspalum</i> sp.	paja			
	<i>Paspalum stellatum</i>	paja peluda			X
	<i>Paspalum virgatum</i>	cabezona		p	
	<i>Rottboellia cochinchinensis</i>	manisuri		p	
	<i>Saccharum spontaneum</i>	paja blanca			
	<i>Sporobolus</i> sp.	paja			X
Poaceae	<i>Streptochaeta sodiroana</i>	cadillo			
Smilacaceae	<i>Smilax</i> sp.	zarzaparrilla			
Zingiberaceae	<i>Hedychium coronarium</i>	heliotropo		o	
	<i>Renealmia cernua</i>	jengibrillo			
	<i>Renealmia</i> sp.	..			
PINOPSIDA					
Pinaceae	<i>Pinus caribaea</i>	pino caribe	f		
FILICOPSIDA					
Blechnaceae	<i>Blechnum occidentale</i>	fern			
Cyatheaceae	<i>Cyathea</i> sp.	fern			
Dryopteridaceae	<i>Polybotrya</i> sp.	fern			
Gleicheniaceae	<i>Dicranopteris</i> sp.	fern			
Marattiaceae	<i>Danaea</i> sp.	fern			
Polypodiaceae	<i>Campylonuerum</i> sp.	fern			

Name		Common Name	Forestry	Use	La Mesa
	<i>Dicranoglossum panamense</i>	fern			
	<i>Microgramma</i> sp.	fern			
	<i>Plecuma</i> sp.	fern			
	<i>Polypodium</i> sp. 1	fern			
	<i>Polypodium</i> sp. 2	fern			
	<i>Polypodium</i> cf <i>flagelare</i>	fern			
Pteridaceae	<i>Adiantum humile</i>	fern			
	<i>Adiantum lucidum</i>	fern			
	<i>Adiantum</i> sp.	fern			
	<i>Adiantum</i> sp.2	fern			
	<i>Pityrogramma calomelanos</i>	fern			
	<i>Pteris</i> sp.	fern			
Schizaeaceae	<i>Lygodium venustum</i>	fern			
	<i>Salpichlaena volubilis</i>	fern			
Tectariaceae	<i>Tectaria incisa</i>	fern			
Thelypteridaceae	<i>Thelypteris</i> sp.	fern			
Vittariaceae	<i>Vittaria</i> sp.	fern			
LYCOPODIOPSIDA					
Lycopodiaceae	<i>Lycopodiella cernua</i>	..			
Selaginellaceae	<i>Selaginella arthritica</i>	chinese fern			

Source: Field data 2015.

Key: **Forestry:** e: spontaneous in plots; f: outside of plots; p: planted. **Use:** a: food; c: edible; f: fibre, wood, construction material; l: melliferous; o: ornamental; p: grass; r: medicinal; t: toxic; v: live fence.

Fauna

LIST OF BIRDS REGISTERED IN VISITED SITES

Order	Family	Spanish Name	Scientific Name	State	EAP	IUCN	CITES	Las Lajas	La Mesa	Santa Rita	Palmas Bellas
GALLIFORMES											
	Cracidae	Grey-headed chachalaca	<i>Ortalis cinereiceps</i>	R		LC					x
	Odontophoridae	Crested bobwhite	<i>Odontophorus cristatus</i>	R		LC			x		
COLUMBIFORMES											
	Columbidae	White-tipped dove	<i>Leptotila verreauxi</i>	R		LC		x	x		x
	Columbidae	Ruddy ground dove	<i>Columbina talpacoti</i>	R		LC			x		x
TROCHILIFORMES											
	Trochilidae	White-necked jacobin	<i>Florisuga mellivora</i>	R	VU	LC	II			x	
	Trochilidae	Garden emerald	<i>Chlorostilbon assimilis</i>	R	VU	LC	II		x		
	Trochilidae	Long-billed hermit	<i>Phaethornis longirostris</i>	R	VU	LC	II	x			
	Trochilidae	Violet-crowned woodnymph	<i>Thalurania colombica</i>	R	VU	LC	II			x	
	Trochilidae	Sapphire-throated hummingbird	<i>Lepidopyga coeruleogularis</i>	R	VU	LC	II	x		x	x
CUCULIFORMES											
	Cuculidae	Greater ani	<i>Crotophaga major</i>	R		LC					x
	Cuculidae	Smooth-billed ani	<i>Crotophaga ani</i>	R		LC			x		
	Cuculidae	Striped cuckoo	<i>Tapera naevia</i>	R		LC			x		
PELECANIFORMES											
	Ardeidae	Green heron	<i>Butorides virescens</i>	R		LC			x		
CATHARTIFORMES											
	Cathartidae	Turkey vulture	<i>Cathartes aura</i>	R/M		LC			x	x	x
	Cathartidae	Black vulture	<i>Coragyps atratus</i>	R		LC			x	x	x
ACCIPITRIFORMES											

Order	Family	Spanish Name	Scientific Name	State	EAP	IUCN	CITES	Las Lajas	La Mesa	Santa Rita	Palmas Bellas
	Pandionidae	Osprey	<i>Pandion haliaetus</i>	R	VU	LC	II			x	
	Accipitridae	Tiny Hawk	<i>Accipiter superciliosus</i>	R	VU	LC	II			x	
	Accipitridae	Roadside hawk	<i>Rupornis magnirostris</i>	R	VU	LC	II				x
	Accipitridae	Great black hawk	<i>Buteogallus urubitinga</i>	R	VU	LC	II				x
PICIFORMES											
	Ramphastidae	Keel-billed toucan	<i>Ramphastos sulfuratus</i>	R	VU	LC	II	x		x	
	Ramphastidae	Collared aracari	<i>Pteroglossus torquatus</i>	R		LC					x
	Picidae	Crimson-crested woodpecker	<i>Campephilus melanoleucos</i>	R		LC		x			
	Picidae	Red-crowned woodpecker	<i>Melanerpes rubricapillus</i>	R		LC		x		x	x
FALCONIFORMES											
	Falconidae	Slaty-backed forest falcon	<i>Micrastur mirandollei</i>	R	VU	LC	II				x
	Falconidae	Yellow-headed caracara	<i>Milvago chimachima</i>	R		LC	II		x		
PSITTACIFORMES											
	Psittacidae	Orange-chinned parakeet	<i>Brotogeris jugularis</i>	R	VU	LC	II				x
	Psittacidae	Red-lored amazon	<i>Amazona autumnalis</i>	R	VU	LC	II				x
	Psittacidae	Yellow-crowned amazon	<i>Amazona ochrocephala</i>	R	VU	LC	II		x		x
	Psittacidae	Brown-throated parakeet	<i>Eupsittula pertinax</i>	R	VU	LC	II		x		
	Psittacidae	Crimson-fronted parakeet	<i>Psittacara finschi</i>	R	VU	LC	II		x		
PASSERIFORMES											
	Pipridae	Lance-tailed manakin	<i>Chiroxiphia lanceolata</i>	R		LC			x		

Order	Family	Spanish Name	Scientific Name	State	EAP	IUCN	CITES	Las Lajas	La Mesa	Santa Rita	Palmas Bellas
	Pipridae	Green manakin	<i>Xenopipo holochlora</i>	R		LC					x
	Cotingidae	White-winged becard	<i>Pachyramphus polychopterus</i>	R		LC				x	
	Tyrannidae	Yellow-crowned tyrannulet	<i>Tyrannulus elatus</i>	R		LC					x
	Tyrannidae	Greenish elaenia	<i>Myiopagis viridicata</i>	R		LC		x			x
	Tyrannidae	Social flycatcher	<i>Myiozetetes similis</i>	R		LC			x		
	Tyrannidae	Lesser kiskadee	<i>Pitangus lictor</i>	R		LC					x
	Tyrannidae	Great kiskadee	<i>Pitangus sulphuratus</i>	R		LC		x	x		
	Tyrannidae	Streaked flycatcher	<i>Myiodynastes maculatus</i>	R		LC			x		
	Tyrannidae	Tropical kingbird	<i>Tyrannus melancholicus</i>	R		LC			x		
	Thamnophilidae	Fasciated antshrike	<i>Cymbilaimus lineatus</i>	R		LC				x	
	Thamnophilidae	Black-hooded antshrike	<i>Thamnophilus bridgesi</i>	R		LC		x			
	Thamnophilidae	Rufous-winged antwren	<i>Herpsilochmus rufimarginatus</i>	R		LC					x
	Thamnophilidae	Dusky antbird	<i>Cercomacra tyrannina</i>	R		LC		x		x	
	Furnariidae	Pale-breasted spinetail	<i>Synallaxis albescens</i>	R		LC			x		
	Dendrocolaptidae	Cocoa woodcreeper	<i>Xiphorhynchus susurrans</i>	R		LC					x
	Vireonidae	Red-eyed vireo	<i>Vireo olivaceus</i>	M		LC					x
	Vireonidae	Golden-fronted greenlet	<i>Hylophilus aurantiifrons</i>	R		LC					x
	Vireonidae	Tawny-crowned greenlet	<i>Hylophilus ochraceiceps</i>	R		LC					x
	Vireonidae	Lesser greenlet	<i>Hylophilus decurtatus</i>	R		LC					x
	Corvidae	Black-chested jay	<i>Cyanocorax affinis</i>	R		LC					x
	Hirundinidae	White-thighed swallow	<i>Neochelidon tibialis</i>	R		LC				x	

Order	Family	Spanish Name	Scientific Name	State	EAP	IUCN	CITES	Las Lajas	La Mesa	Santa Rita	Palmas Bellas
	Troglodytidae	House wren	<i>Troglodytes aedon</i>	R		LC			x		
	Poliophtilidae	Tropical gnatcatcher	<i>Poliophtila plumbea</i>	R		LC		x			
	Mimidae	Gray catbird	<i>Dumetella carolinensis</i>	M		LC				x	
	Mimidae	Tropical mockingbird	<i>Mimus gilvus</i>	R		LC				x	x
	Turdidae	Clay-colored thrush	<i>Turdus grayi</i>	R		LC			x	x	
	Parulidae	Tennessee warbler	<i>Vermivora peregrina</i>	M		LC		x			
	Icteridae	Crested oropendola	<i>Psarocolius decumanus</i>	R		LC					x
	Icteridae	Eastern meadowlark	<i>Sturnella magna</i>	R		LC			x		
	Emberizidae	Wedge-tailed grass finch	<i>Emberizoides herbicola</i>	R		LC			x		
	Emberizidae	Blue-black grassquit	<i>Volatinia jacarina</i>	R		LC			x		
	Thraupidae	Crimson-backed tanager	<i>Ramphocelus dimidiatus</i>	R		LC			x		
	Thraupidae	Blue-gray tanager	<i>Thraupis episcopus</i>	R		LC		x	x	x	x
	Thraupidae	Plain-colored tanager	<i>Tangara inornata</i>	R		LC		x			
	Thraupidae	Red-legged honeycreeper	<i>Cyanerpes cyaneus</i>	R		LC		x			
	Cardinalidae	Scarlet tanager	<i>Piranga olivacea</i>	M		LC		x		x	
	Cardinalidae	Red-crowned ant tanager	<i>Habia rubica</i>	R		LC		x			
	Cardinalidae	Olive tanager	<i>Chlorothraupis carmioli</i>	R		LC				x	
	Thraupidae	Yellow-crowned euphonia	<i>Euphonia luteicapilla</i>	R		LC		x			

Fuente: Datos de campo, 2015; ANAM (2008),

Leyenda: Estado R (Residente, especie que cría en Panamá), M (Migratoria, especie que cría en Norteamérica y realiza viajes de larga distancia). EAP: Especie Amenazada en Panamá según IUCN: LC (criterio de menor riesgo). CITES: II (criterio en el Apéndice II).

ANNEX 3. SPECIES REGISTERED IN PARCELS, BY SITE

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
MAGNOLIOPSIDA					
ANACARDIACEAE					
	<i>Anacardium excelsum</i>		X		
	<i>Astronium graveolens</i>		X		
	<i>Mangifera indica</i>		X		
	<i>Spondias mombin</i>			X	X
ANNONACEAE					
	Annonaceae			X	
	<i>Annona</i> sp.			X	
	<i>Guatteria</i> sp.			X	
	<i>Unonopsis</i> sp.			X	
	<i>Xylopia aromatica</i>		X		
	<i>Xylopia frutescens</i>		X		
APOCYNACEAE					
	<i>Aspidosperma</i> sp.			X	
	<i>Laxoplumeria tessmannii</i>			X	
	<i>Stemmadenia</i> sp.			X	
	<i>Tabernaemontana</i> sp.			X	
	<i>Thevetia ahouai</i>		X		
ARALIACEAE					
	<i>Dendropanax arboreus</i>		X		
	<i>Schefflera morototoni</i>		X	X	
ASTERACEAE					
	Asteraceae				X
	<i>Venonanthura patens</i>	X	X	X	
BIGNONIACEAE					

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
	<i>Jacaranda copaia</i>			X	
BORAGINACEAE					
	<i>Cordia alliodora</i>		X		
	<i>Cordia cymosa</i>			X	
	<i>Cordia panamensis</i>		X		
	<i>Cordia porcata</i>			X	
BURSERACEAE					
	<i>Protium panamense</i>			X	
CAPPARACEAE					
	<i>Capparis discolor</i>			X	
CHLORANTHACEAE					
	<i>Hedyosmum</i> sp.			X	
CHRYSOBALANACEAE					
	Chrysobalanaceae			X	
	<i>Hirtella americana</i>		X	X	
	<i>Hirtella racemosa</i>		X	X	
	<i>Hirtella triandra</i>		X		
CLUSIACEAE					
	Clusiaceae			X	
	<i>Calophyllum brasiliense</i>		X	X	
	<i>Calophyllum longifolium</i>			X	
	<i>Chrysochlamys</i> sp.			X	
	<i>Garcinia</i> sp.			X	
	<i>Marila</i> sp.			X	
	<i>Marila laxiflora</i>			X	
	<i>Symphonia globulifera</i>			X	
	<i>Tovomita stylosa</i>			X	

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
	<i>Vismia latisejala</i>	X	X	X	
	<i>Vismia macrophylla</i>			X	
COCHLOSPERMACEAE					
	<i>Cochlospermum vitifolium</i>		X		X
COMBRETACEAE					
	<i>Terminalia amazonia</i>		X	X	
DILLENACEAE					
	<i>Curatella americana</i>	X	X		
	<i>Davilla kunthii</i>	X			
ELAEOCARPACEAE					
	<i>Sloanea</i> sp.			X	
ERYTHROXYLACEAE					
	<i>Erythroxylon</i> sp.		X	X	
EUPHORBIACEAE					
	<i>Alchornea latifolia</i>			X	
	<i>Hieronyma alchorneoides</i>		X		
	<i>Mabea occidentalis</i>			X	
	<i>Pera arborea</i>			X	
FABACEAE					
	Fabaceae			X	
	<i>Andira inermis</i>		X		
	<i>Cassia moschata</i>		X		
	<i>Enterolobium schomburgkii</i>			X	
	<i>Inga</i> sp. 1			X	
	<i>Inga</i> sp. 2			X	
	<i>Inga</i> sp. 3			X	
	<i>Inga</i> sp. 4			X	

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
	<i>Inga</i> sp. 5			X	
	<i>Inga laurina</i>		X	X	
	<i>Lonchocarpus</i> sp.	X			
	<i>Ormosia</i> sp.			X	
	<i>Pithecellobium</i> sp.			X	
	<i>Pseudosamanea guachapele</i>		X		
	<i>Senna dariensis</i>		X		
	<i>Swartzia simplex</i>			X	
LACISTEMATACEAE					
	<i>Lacistema aggregatum</i>		X	X	
LAMIACEAE					
	<i>Tectona grandis</i>		X		X
LAURACEAE					
	Lauraceae 1			X	
	Lauraceae 2			X	
	<i>Cinnamomum</i> sp.		X		
	<i>Ocotea</i> sp.		X		
	<i>Ocotea</i> cf. <i>linearis</i>		X		
LECYTHIDACEAE					
	<i>Eschweilera</i> sp. 1			X	
	<i>Eschweilera</i> sp. 2			X	
MAGNOLIACEAE					
	<i>Talauma</i> sp.			X	
MALPIGHIACEAE					
	<i>Byrsonima crassifolia</i>	X	X	X	
MALVACEAE					

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
	<i>Apeiba membranacea</i>			X	
	<i>Apeiba tibourbou</i>		X	X	
	<i>Guazuma ulmifolia</i>				X
	<i>Hampea appendiculata</i>			X	
	<i>Helicteres guazumifolia</i>		X		
	<i>Luehea seemannii</i>		X		
	<i>Pachira sessilis</i>			X	
	<i>Waltheria glomerata</i>	X	X		
MELASTOMATACEAE					
	Melastomataceae			X	
	<i>Bellucia pentamera</i>		X		
	<i>Conostegia cinnamomea</i>			X	
	<i>Miconia</i> sp. 1		X	X	
	<i>Miconia</i> sp. 2			X	
	<i>Miconia affinis</i>		X	X	
	<i>Miconia argentea</i>	X	X		
	<i>Miconia impetolaris</i>	X	X		
	<i>Miconia lacera</i>			X	
MELIACEAE					
	<i>Guarea</i> sp.			X	
	<i>Swietenia macrophylla</i>				X
	<i>Trichilia</i> sp.			X	
	<i>Trichilia</i> aff. <i>Pallida</i>		X		
MORACEAE					
	<i>Brosimum</i> sp.			X	
	<i>Brosimum alicastrum</i>			X	
	<i>Ficus insipida</i>		X		

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
	<i>Pseudolmedia</i> sp.			X	
MYRISTICACEAE					
	<i>Otoba</i> sp.			X	
	<i>Virola</i> sp. 1			X	
	<i>Virola</i> sp. 2			X	
	<i>Virola sebifera</i>			X	
MYRTACEAE					
	<i>Myrtaceae</i>			X	
	<i>Eugenia</i> sp. 1			X	
	<i>Eugenia</i> sp. 2			X	
	<i>Eugenia</i> sp. 3			X	
	<i>Eugenia</i> sp. 4			X	
	<i>Eugenia</i> sp. 5			X	
	<i>Eugenia principium</i>		X		
	<i>Myrciaria</i> sp.		X		
	<i>Psidium guineense</i>	X			
	<i>Syzygium jambos</i>		X		
OCHNACEAE					
	<i>Cespedezia spathulata</i>			X	
PIPERACEAE					
	<i>Piper</i> sp. 1		X		
	<i>Piper</i> sp. 2			X	
	<i>Piper marginatum</i>				X
POLYGONACEAE					
	<i>Coccoloba</i> sp.			X	
	<i>Coccoloba caracasana</i>				X

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
PRIMULACEAE					
	<i>Ardisia</i> sp.			X	
RHAMNACEAE					
	<i>Colubrina glandulosa</i>			X	
RUBIACEAE					
	Rubiaceae			X	
	<i>Alibertia edulis</i>	X	X		
	<i>Appunia seibertii</i>		X		
	<i>Chomelia spinosa</i>	X			
	<i>Genipa americana</i>		X		
	<i>Guettarda</i> sp.		X		
	<i>Isertia haenkeana</i>			X	
	<i>Isertia laevis</i>			X	
	<i>Palicourea guianensis</i>			X	
	<i>Palicourea triphylla</i>		X	X	
	<i>Posoqueria latifolia</i>			X	
	<i>Psychotria elata</i>			X	
	<i>Psychotria poeppigiana</i>			X	
	<i>Randia armata</i>		X		
RUTACEAE					
	<i>Zanthoxylum</i> sp. 1		X		
	<i>Zanthoxylum</i> sp. 2			X	
	<i>Zanthoxylum ekmanii</i>			X	
	<i>Zanthoxylum setulosum</i>		X		
SABIACEAE					
	<i>Meliosma</i> sp.			X	
SALICACEAE					

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
	<i>Banara guianensis</i>			X	
	<i>Casearia</i> sp.		X	X	
	<i>Casearia arborea</i>			X	
	<i>Casearia guianensis</i>		X		
	<i>Casearia sylvestris</i>	X			
	<i>Ryania speciosa</i>			X	
SAPINDACEAE					
	<i>Cupania</i> sp. 1			X	
	<i>Cupania</i> sp. 2			X	
	<i>Cupania rufescens</i>			X	
	<i>Cupania sylvatica</i>			X	
	<i>Matayba scrobiculata</i>	X			
	<i>Talisia nervosa</i>			X	
SAPOTACEAE					
	Sapotaceae			X	
	<i>Manilkara bidentata</i>			X	
	<i>Pouteria</i> sp.		X		
SIMAROUBACEAE					
	<i>Simarouba amara</i>		X	X	
SIPARUNACEAE					
	<i>Siparuna</i> sp.			X	
	<i>Siparuna guianensis</i>		X		
SOLANACEAE					
	Solanaceae		X		
	<i>Cestrum</i> sp.		X		X
	<i>Solanum asperum</i>			X	
	<i>Solanum jamaicense</i>			X	

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
ULMACEAE					
	<i>Trema micrantha</i>		X		
URTICACEAE					
	<i>Cecropia insignis</i>				X
	<i>Cecropia longipes</i>				X
	<i>Cecropia peltata</i>	X	X	X	X
VERBENACEAE					
	<i>Lantana camara</i>		X		
VIOLACEAE					
	<i>Rinorea</i> sp.			X	
VOCHYSIACEAE					
	<i>Vochysia ferruginea</i>			X	
DESCONOCIDA					
	Deconocida 1			X	
	Deconocida 2			X	
LILIOPSIDA					
ARECACEAE					
	<i>Acrocomia aculeata</i>		X		
	<i>Bactris</i> sp.			X	
	<i>Bactris gasipaes</i>				X
	<i>Desmoncus orthacanthos</i>			X	
	<i>Euterpe precatoria</i>			X	
	<i>Sabal mauritiformis</i>				X
	<i>Welfia regia</i>			X	
FILICOPSIDA					
CYATHEACEAE					
	<i>Cyathea</i> sp.			X	

NAME		SITE			
		La Mesa	Las Lajas	Santa Rita	Palmas Bellas
		15	66	121	14

Fuente: Datos de campo, 2015

Class and Family	Name	SPL	CITES	End.	Site			
					L M	L L	S R	P B
BROMELIACEAE	<i>Guzmania musaica</i>	VU		Endemic			X	
ORCHIDACEAE	<i>Catasetum</i> sp. 1						X	
	<i>Catasetum</i> sp. 2					X		
	<i>Catasetum viridiflavum</i>	VU	II					X
	<i>Dichaea</i> sp.						X	
	<i>Dimerandra stenopetala</i>					X	X	
	<i>Encyclia cordigera</i>	VU	II		X			
	<i>Encyclia cordigera</i>				X			
	<i>Encyclia</i> sp. 1						X	
	<i>Encyclia</i> sp. 2					X		
	<i>Epidendrum difforme</i>					X		
	<i>Epidendrum nocturnum</i>						X	
	<i>Epidendrum</i> sp. 1						X	
	<i>Epidendrum</i> sp. 2					X		
	<i>Epidendrum stamfordianum</i>	VU	II			X		
	<i>Epidendrum stamfordianum</i>					X		
	<i>Habenaria</i> sp.						X	
	<i>Maxillaria camaridii</i>	VU	II		X			
	<i>Maxillaria camaridii</i>				X			
	<i>Maxillaria</i> sp.					X		
	<i>Oeceoclades maculata</i>					X		X
	<i>Peristeria elata</i>	VU	I				X	
	<i>Polystachya foliosa</i>					X	X	
	<i>Scaphyglottis bidentata</i>						X	
	<i>Scaphyglottis</i> sp.						X	
	<i>Sobralia fragrans</i>						X	
	<i>Sobralia macrophylla</i>	VU	II				X	

Class and Family	Name	SPL	CITES	End.	Site			
					L M	L L	S R	P B
	<i>Sobralia macrophylla</i>						X	
	<i>Spatoglottis plicata</i>						X	
	<i>Vanilla</i> sp.						X	
FILICOPSIDA								
CYATHEACEAE	<i>Cyathea</i> sp.						X	
	Total	27	9	4	9	20	26	16

Source: Field data, 2015

Key: SPL: species protected by national legislation to protect wildlife; por la legislación nacional de protección a la vida silvestre; CITES: species included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora; I: in appendix I, II: in appendix II; End.: National Endemism; Site: LM: La Mesa; LL: Las Lajas; SR: Santa Rita; PB: Palmas Bellas

BIRD SPECIES

ORDER	FAMILY	NAME IN ENGLISH	SCIENTIFIC NAME	State	STP	IUCN	CI
TROCHILIFORMES	TROCHILIDAE	Garden emerald	<i>Chlorostilbon assimilis</i>	R	VU	LC	
		Long-billed hermit	<i>Phaethornis longirostris</i>	R	VU	LC	
		Sapphire-throated hummingbird	<i>Lepidopyga coeruleogularis</i>	R	VU	LC	
		White-necked jacobin	<i>Florisuga mellivora</i>	R	VU	LC	
		Violet-crowned woodnymph	<i>Thalurania colombica</i>	R	VU	LC	
CATHARTIFORMES	CATHARTIDAE	Turkey vulture	<i>Cathartes aura</i>	R/M		LC	
ACCIPITRIFORMES	PANDIONIDAE	Osprey	<i>Pandion haliaetus</i>	M	VU	LC	
	ACCIPITRIDAE	Great black Hawk	<i>Buteogallus urubitinga</i>	R	VU	LC	
	ACCIPITRIDAE	Roadside hawk	<i>Rupornis magnirostris</i>	R	VU	LC	
	ACCIPITRIDAE	Tiny Hawk	<i>Accipiter superciliosus</i>	R	VU	LC	
FALCONIFORMES	Falconidae	Yellow-headed caracara	<i>Milvago chimachima</i>	R		LC	
	Falconidae	Slaty-backed forest falcon	<i>Micrastur mirandollei</i>	R	VU	LC	
PSITTACIFORMES	Psittacidae	Orange-chinned parakeet	<i>Brotogeris jugularis</i>	R	VU	LC	
	Psittacidae	Red-lored amazon	<i>Amazona autumnalis</i>	R	VU	LC	
	Psittacidae	Yellow-crowned amazon	<i>Amazona ochrocephala</i>	R	VU	LC	
	Psittacidae	Brown-throated parakeet	<i>Eupsittula pertinax</i>	R	VU	LC	
	Psittacidae	Finsch's Parakeet	<i>Aratinga finschi</i>	R	VU	LC	
PICIFORMES	Ramphastidae	Keel-billed Toucan	<i>Ramphastos sulfuratus</i>	R	VU	LC	
PASSERIFORMES	Parulidae	Tennessee warbler	<i>Vermivora peregrina</i>	M		LC	
	Cardinalidae	Scarlet tanager	<i>Piranga olivacea</i>	M		LC	
	Mimidae	Gray catbird	<i>Dumetella carolinensis</i>	M		LC	
	VIREONIDAE	Red-eyed vireo	<i>Vireo olivaceus</i>	M		LC	

Source: Field data, 2015.

Key: State R (Resident, species that breeds in Panamá), M (Migratory, that breeds in North America and makes long-distance journeys). STP: Species Threatened in Panamá according to ANAM (2008), IUCN (International Union for Conservation of Nature): LC (least risk criteria). CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora): II (criteria in Appendix II).

ANNEX 5. MAIN CHARACTERISTICS OF THE FARMS

Site and Farm	Plot N°	Type	Area (m ²)	Elevation (m above sea level)	Established	Cleanin g
Manuel Castillo	1	Mixed	1.000	67	2013	m, c
Manuel Castillo	2	Mixed	1.000	65	2013	m, c
Manuel Castillo	3	Pastureland	1.000	67	...	...
La Torcaza	4	Mixed	1.000	196	2013	m, c
Agustín Mendoza	5	Mixed	1.000	229	2013	m, c
La Torcaza	6	Pastureland	1.000	~200	...	...
Sitio La Mesa			6.000			
Carrera	1	Mixed	1.000	39	2011	m
Carrera	2	Mixed	1.000	25	2011	m
Carrera	3	Pastureland	1.000	47	2011	...
Los Ríos	4	Zapatero	1.000	35	2000	m
Los Ríos	5	Teak	1.000	48	1999	m
Los Ríos	6	Yellow Cedar	500	57	1999	m
Madera Fina	7	Yellow Cedar	1.000	66	1994	m
Concordia	8	Mixed	1.000	65	2011	m
Silimín	9	Mixed	1.000	110	2011	m
Sitio Las Lajas			8.500			
Santa Rita	1	Yellow Cedar	1.000	330	2014	m
Santa Rita	2	Mahogany	1.000	254	2014	m
Santa Rita	3	Cocobolo Rosewood	1.000	330	2014	m
Santa Rita	4	Níspero	1.000	395	2010	m
Santa Rita	5	Zapatero	1.000	352	2011	m
Santa Rita	*	OP	7.854	366	2014	m
Sitio Santa Rita			12.854			
Palmas Bellas	1	Teak 2008	1.000	139	2008	m
Palmas Bellas	2	Teak 2012	1.000	122	2012	m, c

Palmas Bellas	3	Teak 2010	1.000	137	2010	m
Palmas Bellas	4	Teak 2011	1.000	133	2011	m
Palmas Bellas	5	Teak 2013	1.000	110	2013	m, c
Reina	6	Teak	1.000	117	2013	m, c
Kapok	7	Yellow Cedar	1.000	93	2008	m
Kapok	8	Almendro	1.000	102	2008	m
Kapok	9	Teak	1.000	105	2008	m
Kapok	10	Cocobolo Rosewood	500	117	2008	m
Kapok	11	Spiny Cedar	1.000	105	2008	m
Palmas Bellas	*	OP	7.854	115	...	...

Palmas Bellas Site**18.354**

Source: Field data 2015. Key: * Only one Observation Point was made; m: mechanical, c: chemical

Form II – Natural Communities / Observation Points

Page 1

FORMULARIO II / Comunidad Natural - Punto de Observación SE: _____ PO: _____ Fecha: _____

Observación general Parcela CódFuente: _____ Fotógrafo: _____ Rollo: _____ Foto: _____ Archivo de GPS: _____

Investigadores: _____ CódElemento: _____

NonSitio: _____ CódSitio: _____ Área protegida: _____

Nombre de la comunidad natural: _____ Área: _____

Nombre del PO: _____ Cartografía: fotos mapas Elevación: _____ msnm

Latitud: _____ Longitud: _____ Comentarios: _____

Forma tierra	Posición Topo	Pendiente	Orientación	Tipo - fisonomía	Geología	Fenología de hojas
Topo montaña	Filo	Cima arriba	Plana 0°	Plano	Bosque abierto	Ignea Ausente
Altiplanicie	Colina	Falda media	Suave 1 - 5°	Variable	Arbustal	Metamórfica
Pie de monte Barranco	Bace	abajo	Media 6 - 14°	N S	Herbazal	denso
Valle	Llanura	Mesa	Semifuerte 15 - 26°	NE SO	No vascular	enano
Depresión	Playa	Variable	Fuerte 27 - 45°	E O	Vegetación escasa	enmarañado
	otra:		Muy fuerte 46 - 69°	SE NO	Suelo desnudo	xerófitico
			Vertical 70 - 90°			

Condición de la comunidad	ColorSuelo	Superficie sin vegetación	Humedad suelo	Sistema ecológico	Profundidad de la capa de materia orgánica
A = excelente	Amarillo	Rojo	Amarillento	% suelo	%
B = buena	Blanco	Violeta	Blancuzco	% piedras	%
C = mala	Gris	Grisáceo			

Formulario II / ESTRUCTURA DE LA VEGETACIÓN Y DOMINANCIA: S.E.: _____ P.O.: _____ Fecha: _____

Estrato / hábito: E = emergente, D = dosel, A = estrato arbóreo inferior, a = arbusivo, l, i = aislados, h = hierba, l = liana, h = hemiepífita, e = epífita, v = no vascular terrestre, t = no vascular epífita/tófito, s = saprófita, p = parásita, f = acuática flotante, r = acuática enraizada, s = acuática sumergida

PCT Cobertura (%): 5= 75-100; 4 = 50-75; 3 = 25-50; 2 = 10-25; 1 = 0-10; D = desconocido; A = abundante; C = común; O = ocasional; R = rara

Altura (m)	Estrato	PCTC	Esp. Más Abundante	Cobertura	Plantas asociadas
> 45					
35 - 45					
25 - 35					
20 - 25					
15 - 20					
10 - 15					
5 - 10					
2 - 5					
0,5 - 2					
< 0,5					

N°	Estrato	Especie	DAP (cm)	Altura (m)	Comentarios	Estrato	Especie	DAP (cm)	Altura (m)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
		Total							

FII – Annex 1: Plants per Observation Point

