

# A preliminary survey and rapid ecological assessment of the avifauna of Amana National Forest (Itaituba and Jacareacanga, Pará, Brazil)

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**ABSTRACT:** Amana National Forest (FLONA Amana) is located on the left bank of the middle Tapajós River, in the interfluvium of the Tapajós and Madeira Rivers, state of Pará, Brazil. I performed a “Rapid Ecological Assessment” (REA) on the bird communities of the park to identify important areas for avian conservation and areas where activities could impact bird communities. Field surveys were carried out at the end of the rainy season and at the beginning of the dry season. Nine points distributed among five sites were sampled within Amana or very close to its borders. Three approaches were used to survey the avifauna of each point: (a) a quantitative approach using mist nets, (b) a qualitative approach using field observations with binoculars, and (c) interviews with local residents. With a sampling effort of 3,320 net hours, interviews with local residents, and approximately 60 additional hours of visual observations, 247 species of birds were recorded belonging to 51 families. Eight taxa are considered endemic to the interfluvium of the Tapajós/Madeira Rivers. Two species are on IUCN’s Red List of endangered birds (*Penelope pileata* and *Guaruba guarouba*), and the known distribution of two species (*Topaza pella* and *Discosura longicaudus*) is extended by our surveys. Two activities within Amana were detected to have possible negative impacts on avifauna, specifically hunting and gold and cassiterite mining.

**KEYWORDS:** birds, Amana National Forest, Amazon, conservation.

## INTRODUCTION

Although the Brazilian Amazon has been subject to scientific study for many decades, due to its large expanse, it is still considered under studied by ornithologists (Oren & Albuquerque 1991). For example, the region between the lower and middle Tapajós River in Pará State has been visited and studied for over 100 years by Brazilian and foreign ornithologists (Snethlage 1908; Oren & Parker 1997; Pacheco & Olmos 2005; Santos *et al.* 2011; Lees *et al.* 2013a). It is estimated that more than 2,000 specimens have been collected from the lower and middle Tapajós River, the area that contains Amazonia National Park (Parque Nacional da Amazônia) and Amana National Forest (Floresta Nacional do Amana). The study of birds in this region over the past 100 years has resulted in the description of 16 new species and records for over 400 bird species in the area between the city of Itaituba and the southern boundary of Amazonia National Park (Oren & Parker 1997). Even recently, new bird species have been described to the interfluvium of the Madeira and Tapajós Rivers, the most recent ones being the Bald Parrot (*Pyrilia aurantiocephala*); Roosevelt Stipple-throated Antwren

(*Epinecophylla dentei*); Alta Floresta Antpitta (*Hylopezus whittakeri*); Chico’s Tyrannulet (*Zimmerius chicomendesi*); and Sucunduri Yellow-margined Flycatcher (*Tolmomyias sucunduri*) (Gaban-Lima *et al.* 2002; Whitney *et al.* 2013a; Carneiro *et al.* 2012; Whitney *et al.* 2013b; Whitney *et al.* 2013c).

Amana National Forest was created by the Brazilian Government by an unnumbered decree on 13 February 2006, and has an area of 540,417.17 ha (DOU 2009). Amana was created to promote sustainable multiple-use management of forest resources; maintain and protect water resources and biodiversity; and support development of methods for the sustainable use of natural resources (DOU 2009).

The goal of this study was to conduct a preliminary survey of the local avifauna to identify potential anthropogenic impacts on and important areas for conservation of bird communities within Amana. I performed a “Rapid Ecological Assessment” (REA; Sayre *et al.* 2003) of Amana. The REA is an integrated methodology used to direct the efforts of conservation planning sites and contributes to the inventories of biodiversity (Sayre *et al.* 2003). Together with information

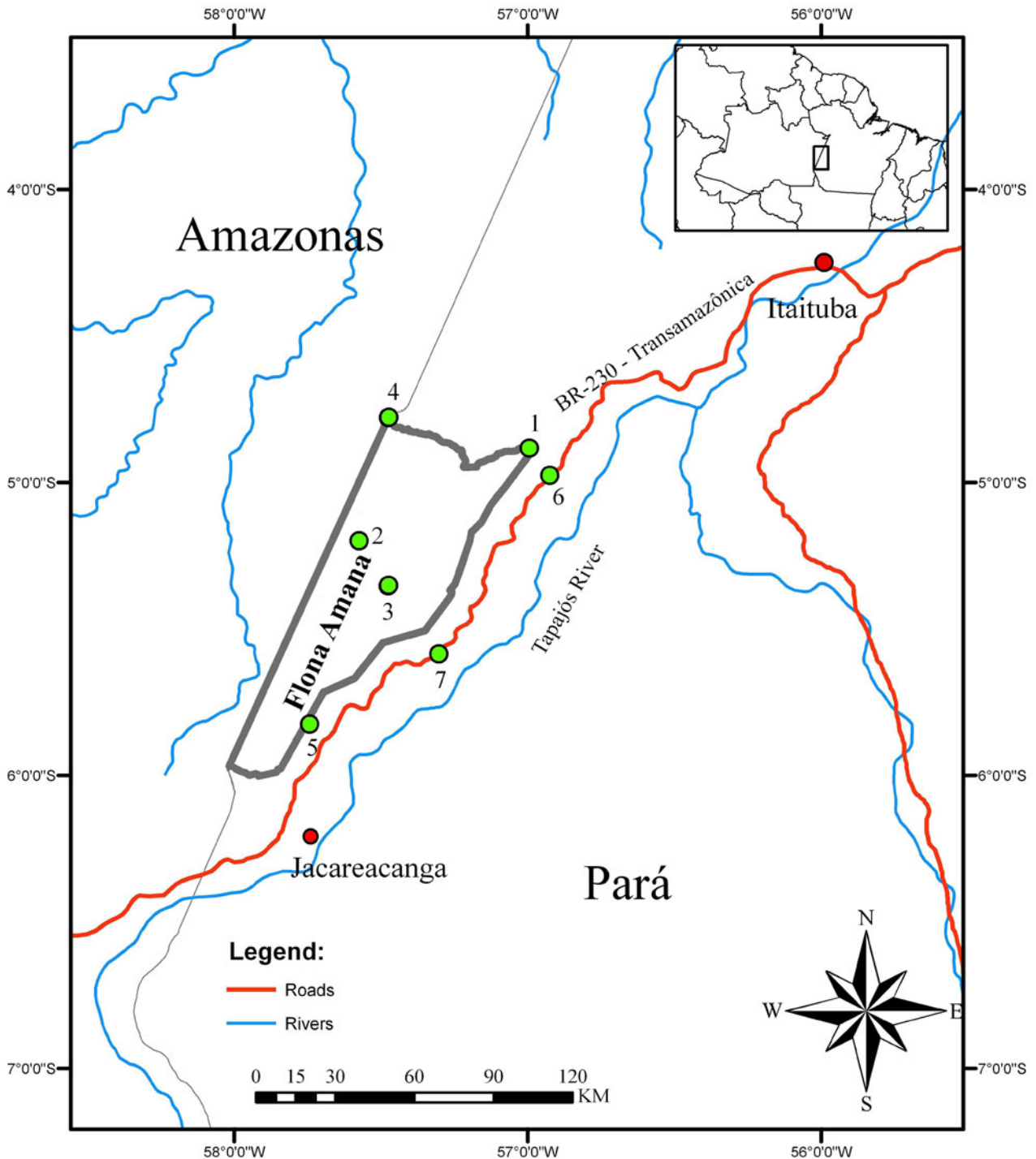
from other taxa, this survey will enable the creation of a management plan for Amana National Forest.

**METHODS**

**Location of Sites and Sampling Period**

Field surveys were performed at the end of the rainy season, from 24 April to 6 May 2008 and at the

beginning of the dry season from 21 July to 8 August 2008. Nine points distributed among five sites were sampled within Amana (Table 1, Figure 1). Four sampled sites were visited during both sampling periods, and one (Site 5 - Igarapé Preto) during only the second sampling period (Table 1). Two additional locations along the Transamazonian Highway were also partially sampled during the sampling period (Sites 6 and 7; Table 1, Figure 1). General information is shown in Table 1, including habitat present at every studied point.



**FIGURE 1.** Location of the Amana National Forest and sampling sites. 1 - Igarapé Montanha (Montanha stream); 2 - JML Gold Mining; 3 - Maranhense Landing Strip; 4 - São Pedro Landing Strip; 5 - Igarapé Preto (Preto stream); 6 - Amana surrounding area (Km 180); 7 - Amana surrounding area (Km 275, Rabelo).

**TABLE 1.** Sites and points of observation and collection of birds during the two campaigns of Rapid Ecological Assessment in Amana National Forest, Pará, Brazil.

Site	Point	Coordinates		Sampling Days	Habitat
		W	S		
1 - Montanha Stream	01	56°58'10.1"W	04°52'58,7"S	25-27 April 2008	Plateau of <i>terra-firme</i> forest
	02	56°58'07.0"W	04°52'55.9"S	22-24 July 2008	Lowland alluvial forest
2 - JML Gold Mining	03	57°32'14.9"W	05°06'35.7"S	29-30 April 2008	<i>Terra-firme</i> forest with palm trees
	04	57°32'07.8"W	05°06'28.3"S	30 July to 01 August 2008	Secondary forest with bamboo
3 - Maranhense	05	57°28'32.0"W	05°21'10.7S	01-03 May 2008	<i>Terra-firme</i> forest with palm trees
	06	57°28'27.0"W	05°21'04.7S	02-04 August 2008	Submontane forest with palm trees
4 - São Pedro	07	57°28'24.7"W	04°46'41.1"S	05-06 May 2008	Vegetation on white sand soil ( <i>campina</i> )
	08	57°28'28.4"W	04°46'43.4"S	26-29 April 2008	Edge of floodplain forest, sandy beaches, and <i>campina</i>
5 - Southern Portion of FLONA (Igarapé Preto)	09	57°42'29,1"W	05°54'31,9"S	06-08 August 2008	Edge of <i>terra-firme</i> forest
6 - FLONA Surrounding		56°55'29.0"	04°58'32.7"	24 April 2008 and 21 July 2008	Km 180 - anthropogenically influenced area (open area)
7 - FLONA Surrounding		57°18'10.8"	05°35'07.1"	05 August 2008	Km 275 – Rabelo - anthropogenically influenced area (open area)

### Species Survey

Three approaches were used to survey the avifauna of each point: (a) quantitative, with mist nets, (b) qualitative, through field observations with binoculars, and (c) interviews with local residents. Scientific nomenclature is in accordance with the Comitê Brasileiro de Registros Ornitológicos (CBRO 2014).

(a) **Mist-net surveys:** Eighteen mist nets were used, 12 x 2 m in length with 36-mm mesh (Rosaminas®). The nets were placed in pre-existing transects at each point where they remained on average for two days. The opening of nets took place soon after sunrise, from 0530 to approximately 1600 h in order to maximize catches. Individuals were identified, photographed, and released. To monitor recaptures during each campaign,

individuals released were marked by cutting the tip of two rectrices. Some individuals were collected and prepared as specimens to document occurrence at the study area. Voucher specimens were taken with the permission of Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis-IBAMA (Brazilian Institute of Environment and Renewable Natural Resources). All collected specimens are currently deposited for further studies at the Museu Paraense Emílio Goeldi, Belém, Pará.

(b) **Observations:** Observations were performed daily with binoculars (Eagle Optics, 8 x 42) from 0600-0900 h. Trails inside the forest, roads, and open areas around the main localities were censused. Occasionally, I made boat trips along rivers and streams near the sites to maximize the observation of riverside species. Since I did not use recording devices, I was unable to identify all vocalizations heard during censuses. I report our observations of the portion of the avian community I was able to positively identify.

(c) **Interviews:** Some local residents, mostly miners, were interviewed about which bird species are best known in the region. In order to minimize the confusion generated by common bird names (which vary from one region to another), books containing photos of Amazonian birds with their species names were shown. This methodology allowed us to check *in loco* whether the species mentioned in the interviews were expected to occur in this region of study.

**Data Analysis**

Aiming to understand the degree of similarity among bird communities at different sites surveyed in this study, similarity analysis was performed. A Jaccard

index was calculated based on the presence and absence of species at each site (Magurran 1988). Cluster analysis was performed using the MVSP 3.1 software package (Kovach 2003).

**RESULTS**

Two hundred forty-seven species of birds belonging to 51 families were recorded (Appendix). The capture effort consisted of 3,320 hours/net and approximately 60 additional hours of visual observation. The most representative families were Thraupidae, Thamnophilidae, Tyrannidae and Psittacidae, with 21, 20, 18, and 14 species, respectively (Appendix). More than 300 individuals were captured by mist net and 130 specimens were collected for further study.

**Similarity Analysis among Sampling Sites**

All sites located within the FLONA had an average similarity above 0.3 (30%), making them more similar to each other when compared to sites located outside the National Forest (Table 2, Figure 2). The dendrogram (Figure 2) resulting from hierarchical cluster analysis showed the formation of two distinct groups: the first group was formed by sites 6 and 7, and the second one by the other sites.

**Endemic Species**

We recorded eight interfluve endemics taxa (Cracraft 1985) in Amana, including Red-throated Piping-Guan (*Aburria kujubi nattereri*), Bar-breasted Piculet (*Picumnus aurifrons borbae*), Hoffmann’s Woodcreeper

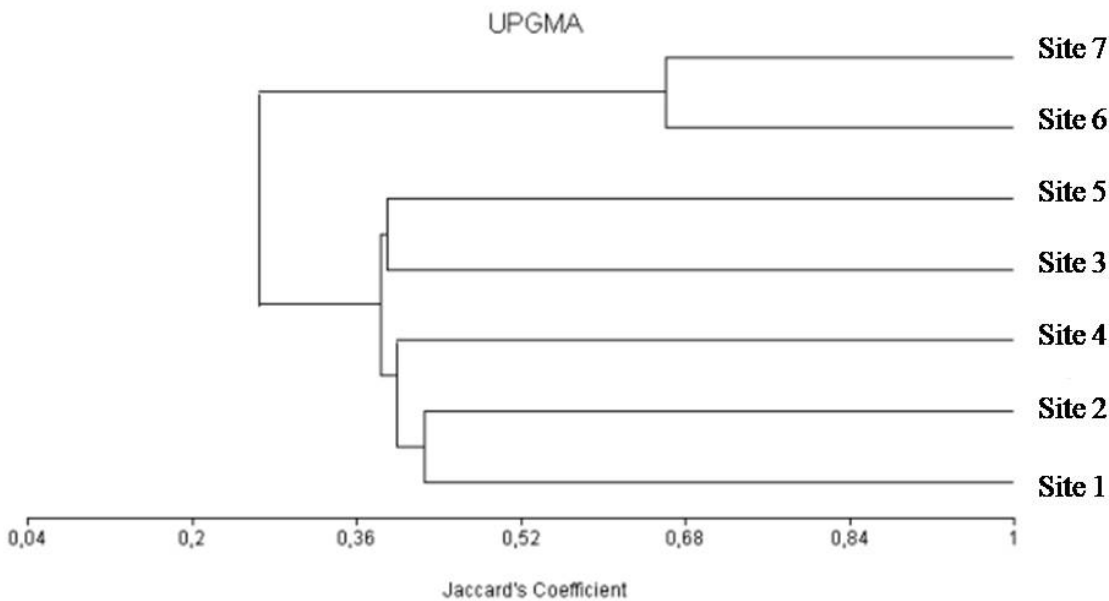


FIGURE 2. Hierarchical clustering analysis for avian survey sites in Amana National Forest using Jaccard similarity distances.

**TABLE 2.** Similarity matrix of Jaccard coefficients among sites surveyed in Amana National Forest.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Site 1	1						
Site 2	0.427	1					
Site 3	0.373	0.427	1				
Site 4	0.391	0.408	0.356	1			
Site 5	0.357	0.415	0.39	0.374	1		
Site 6	0.184	0.279	0.252	0.262	0.351	1	
Site 7	0.193	0.254	0.237	0.25	0.388	0.66	1

(*Dendrocolaptes hoffmannsi*), Ferruginous-backed Antbird (*Myrmoderus ferrugineus elatus*), Long-winged Antwren (*Myrmotherula longipennis ochrogyna*), White-eyed Antwren (*Epinecrophylla leucophthalma phaeonota*), Harlequin Antbird (*Rhegmatorhina berlepschi*), and Pale-faced Antbird (*Phlegopsis borbae*).

### Threatened Species

Among the species observed within the FLONA, at least two deserve special attention because they are on red lists of threatened birds.

White-crested Guan (*Penelope pileata*): Although this species is not included by IBAMA on the list of threatened birds in Brazil, White-crested Guan is on the IUCN's Red List in the Vulnerable category (Birdlife International 2014a). Due to the prospects of future deforestation in the Amazon region, where this species occurs, and its sensitivity to hunting and fragmentation, the conservation status of this species has received considerable attention. This species, as well as other cracids, is used as a source of protein by traditional residents (Brooks *et al.* 2006). During the survey, a single individual of *P. pileata* (Appendix) was observed and photographed on 31 July 2008 (Guilherme 2008).

Golden Parakeet (*Guaruba guarouba*): This psittacid has been recently reclassified as Vulnerable by Birdlife International (2014b). The threat to this species lies mainly in its habitat loss and offspring capture by illegal bird traders (Oren & Novaes 1986; Laranjeiras & Cohn-Haft 2009). In Amana, I observed several flocks of 18 to 22 individuals, flying daily over the camps of sites 3, 4, 5, 6, and 7. Fortunately, residents raising individuals of this species as pets were not detected in Amana or its surroundings. Therefore, in a preliminary assessment, it seems that populations of this species are in good condition within Amana.

### Species of Regional Relevance

During this Rapid Ecological Assessment of Amana National Forest, three important records were made: Bald Parrot (*Pytilia aurantiocephala*), Crimson Topaz (*Topaza pella*), and Racket-tailed Coquette (*Discosura longicaudus*). Crimson Topaz and Racket-tailed records represent an extension of their known geographic ranges; Bald Parrot was only recently described and is poorly known.

Bald Parrot (*Pytilia aurantiocephala*): These parrots with a bare and orange head were for many years considered to be the young of the Vulturine Parrot (*Pytilia vulturina*; Sick 1997). Now recognized as its own species (Gaban-Lima *et al.* 2002), it is endemic to the Brazilian Amazon, with its entire geographical distribution restricted to a narrow band of the southeastern Amazon within interfluves of the Madeira, Tapajós, and Xingu Rivers (InfoNatura 2007; del Hoyo *et al.* 2013). Because it was only described a few years ago, virtually nothing is known about its biology. It is highly recommended that a study be made on its populations including preferential habitat, feeding, and reproductive biology. Gaban-Lima *et al.* (2002) suggest that the preferential habitat of this species is "*campinarana*." Based on our observations in Amana National Forest, the species seems to occur in the canopy of the floodplain forests, where an individual was collected at site 2 (Figure 4; Appendix). This habitat has been one of the most impacted by mining in Amana National Forest. As this species occurs only in a very restricted area that has been suffering intense anthropogenic pressure, the Bald Parrot was recently included on the IUCN's Red List in the Near Threatened category (Birdlife International 2014c).

Crimson Topaz (*Topaza pella*): This magnificent hummingbird is well known from the northeastern Amazon (from Guyana to the region around Belém, Brazil; Schuchmann 1999). Until recently, only two

records of Crimson Topaz had been made in the southern basin of the middle and lower Amazon River, between the cities of Parintins in Amazonas and Santarém in Pará (Hu *et al.* 2000). Davis & Olmstead (2010) reported a compilation of scattered records of this species made in the southern basin of the Amazon River, including the states of Pará, Amazonas, Mato Grosso, and Rondônia. The few records of this species from the southern bank of the Amazon River indicate that it appears to be rare at least in this region. The female specimen of Crimson Topaz collected during this study in Site 3 (Appendix) extends this species' distribution a few kilometers west of the "Trairão" locality, the previous southernmost record of this species from state of Pará (Pacheco & Olmos 2005).

Racket-tailed Coquette (*Discosura longicaudus*): In Amazonia, the occurrence of this species is restricted to a portion of the northeastern basin and the mouth of the Amazon River (Venezuela, Guyana, states of Amazonas, Amapá, and Pará, in Brazil; Schuchmann 1999; Daffonseca 2010). There are also a few records of this species in the Brazilian Atlantic Forest (Schuchmann 1999, InfoNatura 2007, Albano 2012). During the first field campaign at Site 3, one individual of this species was photographed at the forest edge (Figure 5). We observed the species and collected one individual in the same place three months later (Appendix). These records considerably extend the geographical distribution of this species, so that it reaches the southern Brazilian Amazon.

Surely, this species must be quite rare in the region, which would explain the fact that no record of it has been made until now.

Black-bellied Thorntail (*Discosura langsdorffi*): This little hummingbird was known only from the western Amazon (Colombia, Ecuador, Peru, Bolivia, and Brazil) and the Brazilian Atlantic Forest (Schuchmann 1999). The first records of this species in the southern portion of the eastern Amazon were made in Alta Floresta, Mato Grosso (Zimmer *et al.* 1997). More recently the Black-bellied Thorntail was recorded in the Carajás region (Pacheco *et al.* 2007) and Parauapebas, southeastern Pará (Endrigo 2011). It seems to be a rare species whose populations in the Atlantic Forest (states of Bahia, Espírito Santo, and Rio de Janeiro) are endangered, mainly due to deforestation (IBAMA 2003; Olmos 2005). There is no information on the conservation status of this species in the eastern portion of the Amazon, a region that has suffered enormous anthropogenic pressures (Capobianco *et al.* 2001). There is urgent need to carry out a study on the distribution and abundance of this taxon within Amana National Forest. During the two field campaigns, this species was only seen and photographed (Figure 3) at forest edge in Site 3 (Maranhese; Appendix, Figure 3). Further study of this species should work to identify its preferred habitats in the region, so that they can be protected within Amana.



**FIGURE 3.** Black-bellied Thorntail (*Discosura langsdorffi*). Species recorded in secondary forest edge within Amana National Forest. Besides being a species of interest for conservation, this record extends its known geographical distribution in the Brazilian Amazon.



**FIGURE 4.** Bald Parrot (*Pyrilia aurantiocephala*). Species present in Amana National Forest; still little known regarding its geographical distribution and ecological requirements. This record adds important information for this species.



**FIGURE 5.** Racket-tailed Coquette (*Discosura longicaudus*). The record of this species in Amana National Forest extends its distribution in the Brazilian Amazon.

### Species Associated with Specific Habitats

Besides *terra-firme* and floodplain forests, in Amana National Forest there is a vegetation type known as *campina*, which is found on white sand soil. *Campina* vegetation has a low height, with a high density of small and thin trees, and scarcity of emergent trees. *Campina* shelters a number of species that are closely associated with this habitat (Oren 1981; Borges 2004; Guilherme & Borges 2011). Even after obtaining information by local residents regarding the presence of several spots of *campina* and *campinarana* in Amana National Forest, it was only possible to inventory a small portion of this habitat at site 4.

Below are comments on some recorded species associated with this vegetation type:

Red-shouldered Tanager (*Tachyphonus phoenicius*): This species is associated with *campina* and *campinarana* throughout the Amazon (Oren 1981; Borges 2004). One individual was collected in April 2008 (Appendix) during the first field campaign.

Flame-crowned Manakin (*Heterocercus linteatus*): This is an uncommon species associated with sandy soil vegetation, mostly near black water rivers and streams

(Polleto & Aleixo 2005). It was observed on the banks of Igarapé Porquinho at Site 3 and Igarapé Preto at Site 5. One individual was collected in a *campina* spot at Site 4 (Appendix).

White-bearded Manakin (*Manacus manacus*): Although this species is found in many types of environments within the Amazon, including *terra-firme* forest and secondary vegetation, referred to as *capoeira*, (Sick 1997), its abundance seems to increase significantly in *campina* (pers. obs.). Throughout the field campaign, 12 individuals of White-bearded Manakin were captured. All observed and captured individuals were along the stretch of *campina* at Site 4.

### Environmental Impacts

Two types of impacts on the environment of Amana were identified: one that affects the ecosystem as a whole (mining), and another that directly affects the populations of game birds (hunting).

**Mining** - Environmental changes caused by mining, either gold or cassiterite, were detected at all sites (Figure 6) except for Site 1.



FIGURE 6. Washing soil to extract gold within Amana National Forest. Note the crater formed in the woods due to soil leaching.



**Evidence of Hunting** - Bird hunting activity, especially for food, was detected at all surveyed points within Amana, except Site 1, which had no homes

nearby. The bird families most affected appear to be Cracidae (Curassows and Guans) and Anatidae (Table 3; Figure 7).

TABLE 3. Evidence of hunting at surveyed sites.

Location	Hunted Species	Evidence
Site 2 (JML Gold Mining)	Crestless Curassow ( <i>Pauxi tuberosa</i> )	feathers
	Scarlet Macaw ( <i>Ara macao</i> )	feathers
Site 3 (Maranhense)	Crestless Curassow ( <i>Pauxi tuberosa</i> )	feathers
	Red-throated Piping-Guan ( <i>Aburria cujubi</i> )	carcass
Site 4 (São Pedro)	Ornate Hawk-Eagle ( <i>Spizaetus ornatus</i> )	carcass
	Black-bellied Whistling-Duck ( <i>Dendrocygna autumnalis</i> )	carcass (Figure 7)
Site 5 (Igarapé Preto)	Gray Tinamou ( <i>Tinamus tao</i> )	Witnessed eggs collected for consumption



FIGURE 7. Black-bellied Whistling-duck (*Dendrocygna autumnalis*) hunted by a local resident.

## DISCUSSION

The number of species reported during this study is about 45% less than the number of expected species for the total area of Amana National Forest. Oren & Parker (1997) recorded 448 bird species in Amazonia National Park. As Amazonia National Park is limited to the south

by Amana National Forest, it is plausible that many species found in this park are also present within Amana. Because the sampling effort of this Rapid Ecological Assessment was much smaller than the effort used in Amazonia National Park (Oren & Parker 1997), many species will be added to this preliminary list (Appendix) as more surveys are accomplished in Amana.

### Similarity Analysis among Sampling Sites

The two distinct groups shown in the dendrogram (Figure 2) were expected. The separation of Sites 6 (Km 180) and 7 (Km 275; Figure 2) were expected since these sites were located in an open area and quite anthropogenically influenced. At these sites, most bird species are associated with open environments and/or forest edges, differentiating these communities from ones located in sites within Amana. The second group formed by sites 1, 2, 3, 4, and 5 have in common the fact that they are located in a predominantly forest-based habitat of Amana. Three subdivisions within this group can be noted. The first subdivision includes Sites 5 (southern portion of Amana) and 3 (Maranhense), in which the relative proximity and likeness among explored habitats explain similarities among their avian communities. The second subdivision groups Sites 1 (Montanha stream) and 2 (JML Gold Mining), which are highly similar to each other (Table 2). This resemblance can be explained due to the presence of *terra-firme* forest with plateaus and well-marked shallows. The third subdivision is formed only by Site 4 (São Pedro), located at an intermediate position between the first and second groups of sites (Figure 2). The most plausible explanation for this separation seems to be the presence of two types of environments within

the site, which were not sampled at other points. The first habitat type refers to the floodplain forest and sandy beaches along the Amana River passing through this site. The presence of this medium-sized river with a range of micro-aquatic habitats allowed observation of some species that were not detected at other sites (Appendix). However, the largest contributor to the separation of this site from the others was the presence of the white-sand “*campina*” forest (*sensu*, Anderson 1981; Guilherme & Borges 2011). I dedicated special attention to the *campina* spot in Site 4, and recorded some species typical of *campina* that were not found at other sampled sites (Appendix).

### Endemic Species

According to Cracraft (1985), 21 taxa are considered endemic to the interfluvium of the Tapajós and Madeira Rivers. Eight (38.0%) of these taxa were recorded in Amana. White-crested Guan (*Penelope pileata*), Crimson-bellied Parakeet (*Pyrrhura perlata*) and Snow-capped Manakin (*Lepidothrix nattereri*) are cited in the list by Cracraft (1985) as endemic in this interfluvium and were recorded in this work (Appendix). However, later studies showed that White-crested Guan occur in almost the entire southern bank of the middle and lower Amazon River (InfoNatura 2007, Brooks *et al.* 2006) and Crimson-bellied Parakeet and Snow-capped Manakin have been recorded out of the interfluvium of the Tapajós/Madeira Rivers in Rondônia and Mato Grosso States (Cordasso 2014; Lees *et al.* 2013b; Zanon 2013).

### Species Associated with Specific Habitats

The detection of species closely associated with *campina* and species with higher abundance in this habitat is a clear indication of its importance for the maintenance of local biodiversity. It is necessary to find strategies for preserving this ecosystem against anthropogenic alteration. It is important that biological studies be undertaken at these *campinas*, which likely hold other rare or geographically restricted species whose survival depends solely on maintaining this habitat intact. Despite not being as rich in species as other Amazonian environments (Oren 1981; Borges 2004), they contribute significantly to the increase of  $\alpha$  (local) and  $\beta$  (regional) diversity because some species are restricted only to this habitat (Oren 1981; Stotz *et al.* 1996; Guilherme & Borges 2011). In the case of Amana National Forest, it was only possible to sample a small portion of *campina* located at Site 4. It is essential that the other areas of *campina* within Amana be identified, studied, and preserved. It is important not only to preserve the *campinas* intact, but also to maintain the matrix of trees around them. This maintenance may contribute significantly to the health of the environment.

### Environmental impacts

**Mining** -- When gold mining is performed manually, the impacts are minimal. Mechanized operation, on the other hand, causes huge changes in the environment. The problem lies in the fact that miners dissolve the forest floor with water jets as they search for small fragments of gold mixed with underground argillaceous rock (Figure 6). As a result of this procedure, damage is caused to fauna and flora on various levels: the first and most harmful is forest destruction (in general, the floodplain forest) in the operation area (Figure 6); the second is the transport of large amounts of sediment into rivers and streams, forming craters without vegetation at places of operation (Figure 6); third is the use of chemicals (*e.g.*, mercury and diesel), the waste of which often remains in the area and is not disposed of properly. Mining, besides destroying the main habitats of shorebird species, can also cause the death of the birds, due to harmful, but commonly used, chemicals being released into the environment through seepage or accidents.

**Hunting** – Hunting, even for subsistence, may reduce the abundance of game species in the Amazon forest (Thiollay 2005). Avian species hunted as game are often naturally rare in tropical forests (Pizo 2001), exacerbating hunting's effects on their populations. If hunting is associated with deforestation or any other type of human-caused habitat modification, populations of these species can be drastically reduced and become extinct at certain sites within a few years. Hunting in the FLONA is not yet considered as serious a problem as mining. However, it is necessary to conduct an awareness campaign with local residents. A good awareness campaign could prevent populations of the most persecuted species from being reduced to unsustainable levels. In combination, habitat management tactics like selective logging are essential to ensure persistence of game species' populations. An investigation into the combined effects of this type of forest management as well as hunting pressures on populations of game birds is recommended to understand how best to maintain game species' populations in the long term.

### Final Considerations

Although I remained only four days (on average) at each point, and census methods did not sample the entire avian community, our results are useful. More than half (54.9%) of the expected species for the study area were detected, considering all 448 species recorded in Amazonia National Park and its vicinity (Oren & Parker, 1997). These data were sufficient for performing a Rapid Ecological Assessment (Sayre *et al.* 2003). The survey conducted was preliminary — just enough to compile the REA and identify important areas for biodiversity

conservation in Amana National Forest. Detection of bird species in the Amazon demands an enormous effort of fieldwork. However, this effort is not normally used in rapid studies aimed at implementing Management Plans (Vasconcelos 2006).

Despite problems related to mining and hunting, the general state of Amana National Forest conservation is still satisfactory. The complications seem to be concentrated along major rivers and streams in Amana, which somehow has protected the *terra-firme* (upland) forests in interfluvies. The *terra-firme* forests that are distant from areas where mining is more intense are well preserved and meet all the conditions to maintain viable populations of large birds, such as the Razor-billed Curassow (*Pauxi tuberosa*), as well as large birds of prey. In fact, several curassow flocks within Amana were observed, indicating no significant hunting activity in areas where there is no mining. Additionally, local residents have confirmed the presence of Harpy Eagle at almost all sampling points. The presence of the above listed species, coupled with the occurrence of other cracids such as the Red-throated Piping-Guan (*Aburria kujubi*) and guans (*Penelope sp.*), trumpeters (*Psophia viridis*), large Psittacidae (parrots), and Ramphastidae (toucans), indicate good environmental health of much of Amana.

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## REFERENCES

- Albano, C. 2012. [WA681177, *Discosura longicaudus* (Gmelin, 1788)]. www.wikiaves.com/681177 (access on: 30 October 2012).
- Anderson, A. B. 1981. White-sand vegetation of Brazilian Amazônia. *Biotropica*, 13:199-210.
- BirdLife International 2014a. Species factsheet: *Penelope pileata*. <http://www.birdlife.org> (access on 23 January 2014).
- BirdLife International 2014b. Species factsheet: *Guaruba guarouba*. <http://www.birdlife.org> (access on 28 January 2014).
- BirdLife International 2014c. Species factsheet: *Pyrrhuloxia aurantiocephala*. <http://www.birdlife.org> (access on 28 January 2014).
- Borges, S. H. 2004. Species poor but distinct: bird assemblages in white sand vegetation in Jaú National Park, Brazilian Amazon. *Ibis*, 146:114-124.
- Brooks, D. M. (Ed.). 2006. *Conserving cracids: the most threatened family of birds in the Americas*. Houston: Miscellaneous Publication of Houston Museum of Natural Science, No. 6.
- Carneiro, L. S.; Gonzaga, L. P.; Rêgo, P. S.; Sampaio, I.; Schneider H.; & Aleixo, A. 2012. Systematic revision of the Spotted Antpitta (Grallariidae: *Hylopezus macularius*), with description of a cryptic new species from Brazilian Amazonia. *Auk*, 129: 338-351.
- Capobianco, J. P. R.; Veríssimo, A.; Moreira, A.; Sawyer, D.; Santos, I.; & Pinto, L. P. 2001. *Biodiversidade na Amazônia brasileira: avaliação e ações prioritárias para conservação, uso sustentável e repartição de benefícios*. São Paulo: Estação Liberdade.
- CBRO. 2014. Comitê Brasileiro de Registros Ornitológicos. *Lista das aves do Brasil*, 11ª edição. [www.cbro.org.br/CBRO/listabr.htm](http://www.cbro.org.br/CBRO/listabr.htm). (access on 20 January 2014).
- Cordasso, V. 2014. [WA1247778, *Lepidothrix nattereri* (Slater, 1865)]. www.wikiaves.com/1247778 (access on: 13 March 2014).
- Cracraft, J. 1985. Historical biogeography and patterns of differentiation within the South American avifauna: areas of endemism. *Ornithological Monographs*, 36:49-84.
- DOU. 2009. *Diário oficial da união*. Number 91, 15 May 2009, Section 1, p. 88. Federal Government of Brazil.
- Daffonseca, J. A. 2010. [WA217099, *Discosura longicaudus* (Gmelin, 1788)]. www.wikiaves.com/217099 (access on 30 October 2012).
- Davis, B. J. W & Olmstead, S. T. 2010. Aves, Apodiformes, Trochilidae, *Topaza pella* (Linnaeus, 1758): a range reinforcement in Amazonian Brazil. *Check List*, 6: 397-399.
- del Hoyo, J., Elliott, A., Sargatal, J., & Christie, D. A. 2013. *Handbook of the birds of the world*. Special volume: new species and global index. Barcelona: Lynx Edicions.
- Endrigo, E. 2011. [WA419216, *Discosura langsdorffi* (Temminck, 1821)]. www.wikiaves.com/419216 (access on: 30 October 2012).
- Gaban-Lima, R.; Raposo, M. A.; & Höfling, E. 2002. Description of a new species of *Pionopsitta* (Aves: Psittacidae) endemic to Brazil. *Auk*, 119:815-819.
- Guilherme, E. & Borges, S. H. 2011. Ornithological records from a *campinal/campinarana* enclave on the upper Juruá river, Acre, Brazil. *The Wilson Journal of Ornithology*, 123:24-32.
- Guilherme, E. 2008. [WA436254, *Penelope pileata* Wagler, 1830]. www.wikiaves.com/436254 (access on: 09 November 2012).
- Hu, D. S.; Joseph, L.; & Agro, D. 2000. Distribution, variation, and taxonomy of *Topaza* hummingbirds (Aves: Trochilidae). *Ornitologia Neotropical*, 11:123-142.
- IBAMA 2003. Lista nacional das espécies brasileiras ameaçadas de extinção. <http://www.mma.gov.br/port/sbf/fauna/index.cfm>. (access on 23 August 2008).
- InfoNatura. 2007. Animals and ecosystems of Latin America, v. 5.0. Arlington: NatureServe. <http://www.natureserve.org/infonatura>. (access on 23 August 2008).
- Laranjeiras, T. O. & Cohn-Haft, M. 2009. Where is the symbol of Brazilian Ornithology? The geographic distribution of the Golden Parakeet (*Guaruba guarouba* – Psittacidae). *Revista Brasileira de Ornitologia*, 17:1-19.
- Lees, A. C., Moura, N. G., Andretti, C. B.; Davis, B. J. W.; Lopes, E. V.; Henriques, L. M. P.; Aleixo, A.; Barlow, J.; Ferreira, J.; & Gardner, T. A. 2013a. One hundred and thirty-five years of avifaunal surveys around Santarém, central Brazilian Amazon. *Revista Brasileira de Ornitologia*, 21: 16-57.
- Lees, A.C.; Zimmer, K.J.; Marantz, C.M.; Whittaker, A.; Davis, B. J. W.; & Whitney, B.M. 2013b. Alta Floresta revisited: an updated review of the avifauna of the most intensively surveyed site in south-central Amazonia. *Bulletin of the British Ornithologist's Club*. 133: 178-239.
- Kovach, W. 2003. Multi-variate Statistical Package Version 3.13 for Windows. Anglesey, Wales: Kovach Computing Services.
- Magurran, A. E. 1988. *Ecological diversity and its measurement*. Princeton: Princeton University Press.

- Olmos, F. 2005.** Aves ameaçadas, prioridades e políticas de conservação no Brasil. *Natureza & Conservação*, 3:21-42.
- Oren, D. C. & Novaes, F. C. 1986.** Observations on the Golden Parakeet *Aratinga guarouba* in Northern Brazil. *Biological Conservation*, 36:329-337.
- Oren, D. C. 1981.** *Zoogeographic analysis of the white sand campina avifauna of Amazonia*. PhD dissertation. Cambridge: Harvard University, Department of Biology.
- Oren, D. C., & Albuquerque, H. G. 1991.** Priority areas for new avian collections in Brazilian Amazonia. *Goeldiana – Zoologia*, 6:1-11.
- Oren, D. C. & Parker, T. A. I. 1997.** Avifauna of the Tapajós National Park and vicinity, Amazonian Brazil. *Ornithological Monographs*, 48:493-525.
- Pacheco, J. F. & Olmos, F. 2005.** Birds of a latitudinal transect in the Tapajós-Xingu interfluvium, eastern Brazilian Amazonia. *Aranajuba*, 13:25-44.
- Pacheco, J. F.; Kirwan, G. M.; Aleixo, A.; Whitney, B. M.; Whittaker, A.; Minns, J.; Zimmer, K. J.; Fonseca, P. S. M.; Lima, M. F. C.; & Oren, D. C. 2007.** An avifaunal inventory of the CVRD Serra dos Carajás project, Pará, Brazil. *Cotinga*, 27:15-30.
- Pizo, M. A. 2001.** A conservação das aves frugívoras, p. 49-59. In: Albuquerque, J. L. B.; Cândido-Jr. J. F.; Straube F. C.; & Roos A. L. (eds.). *Ornitologia e conservação: da ciência às estratégias*. Tubarão: Universidade do Sul de Santa Catarina.
- Poletto, F. & Aleixo, A. 2005.** Implicações biogeográficas de novos registros ornitológicos em um enclave de vegetação de campina no sudoeste da Amazônia brasileira. *Revista Brasileira de Zoologia*, 22:1196-1200.
- Santos, M. P. D.; Aleixo, A. L. P.; Horta, F. M.; & Portes, E. 2011.** Avifauna of the Juruti region, Pará, Brazil. *Revista Brasileira de Ornitologia*, 19: 134-153.
- Sayre, R.; Roca, E.; Sedaghatkish, G.; Young, B.; Keel, S.; Roca, R.; & Sheppard, S. 2003.** *Natureza em foco: avaliação ecológica rápida*. Arlington: The Nature Conservancy.
- Schuchmann, K. L. 1999.** Family Trochilidae (Hummingbirds), p. 468-680. In: del Hoyo, J.; Elliott, A.; & Sargatal, J. (eds.) *Handbook of the Birds of the World*, v. 5. Barcelona: Lynx Edicions.
- Sick, H. 1997.** *Ornitologia Brasileira*. Rio de Janeiro: Editora Nova Fronteira.
- Snethlage, E. 1908.** Ornithologisches vom Tapajoz und Tocantins. *Journal of Field Ornithology*, 56:493-539.
- Stotz, D. F.; Fitzpatrick, J. W.; Parker, T. A. I.; & Moskovits, D. K. 1996.** *Neotropical birds: ecology and conservation*. Chicago: University of Chicago Press.
- Thiollay, J.-M. 2005.** Effects of hunting on Guianan forest game birds. *Biodiversity and Conservation*, 14: 1121-1135.
- Vasconcelos, M. F. 2006.** Uma opinião crítica sobre a qualidade e a utilidade dos trabalhos de consultoria ambiental sobre a avifauna. *Atualidades Ornitológicas*, 131:10-12
- Whitney, B. M.; Isler, M. L.; Bravo, G. A.; Aristizábal, N. A.; Schunck, F.; Silveira, L. F.; & de Q. Piacentini, V. 2013a.** A new species of *Epinecrophylla* antwren from the Aripuanã-Machado interfluvium in central Amazonian Brazil with revision of the “stipple-throated antwren” complex, p. 263-267. In: del Hoyo, J.; Elliott, A.; Sargatal, J.; & D. A. Christie (eds.). *Handbook of the Birds of the World*. Special volume: new species and global index. Barcelona: Lynx Edicions.
- Whitney, B. M.; Schunck, F.; Rêgo, M. A.; & Silveira, L. F. 2013b.** A new species of *Zimmerius* tyrannulet from the upper Madeira-Tapajós interfluvium in central Amazonian Brazil: birds don't always occur where they “should”, p. 286-291. In: del Hoyo, J.; Elliott, A.; Sargatal, J.; & Christie, D. A. (eds.). *Handbook of the Birds of the World*. Special volume: new species and global index. Barcelona: Lynx Edicions.
- Whitney, B. M., F. Schunck, M. A. Rêgo, & D L. F. Silveira. 2013c.** A new species of flycatcher in the *Tolmomyias assimilis* radiation from the lower Sucunduri-Tapajós interfluvium in central Amazonian Brazil heralds a new chapter in Amazonian biogeography, p. 297-300. In: del Hoyo, J., Elliott, A.; Sargatal, J.; & D. A. Christie (eds.). *Handbook of the Birds of the World*. Special volume: new species and global index. Barcelona: Lynx Edicions.
- Zanon, J. P. 2013.** [WA996288, *Pyrrhura perlata* (Spix, 1824)]. www.wikiaves.com/996288 (access on: 13 March 2014).
- Zimmer, K. J.; Parker, T. A.; Isler, M. L.; & Isler, P. R. 1997.** Survey of a southern Amazonian avifauna: the Alta Floresta region, Mato Grosso, Brazil, p. 887-918 In: Remsen, J. V. (ed.). *Studies in Neotropical ornithology honoring Ted Parker*. *Ornithological Monographs* 48.

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APPENDIX:

**List of bird species recorded in Amana National Forest and its surroundings, with information on habitat. Sites:** 1 - Right bank of Montanha Stream; 2 - JMS Gold Mining, right bank of Porquinho Stream; 3 - Maranhense; 4 - São Pedro, on the right bank of Amana River; 5 - Igarapé Preto, Southern FLONA point; 6 - FLONA surrounding area, km 180, at the banks of Transamazon Highway; and 7 - FLONA surrounding area, km 275, Rabelo Location. **Record Type:** I – interview, O - observation, P - photo published on WikiAves (www.wikiaves.org), S - specimen collected and deposited in the Museu Paraense Emílio Goeldi, V - recognized vocalization. **Habitats:** A - anthropogenic area; AE - aerial environment, ETF - edge of *terra-firme* rainforest; EFR - edge of floodplain rainforest, ESR - edge of second-growth forest, FR - floodplain rainforest, O - open area, R – banks of rivers and lakes, P - ponds of water along roads and highways, Pa – pasture, S - sandy soil vegetation, TF – *terra-firme* rainforest.

Family and Species	English Name	Habitat	Records Type	Sites
<b>TINAMIDAE</b>				
<i>Tinamus tao</i>	Gray Tinamou	TF	V Recorded evidence (egg)	1, 2, 3, 4, 5
<i>Tinamus major</i>	Great Tinamou	TF	I <sup>1</sup>	2, 3, 4
<i>Crypturellus cinereus</i>	Cinereous Tinamou	TF	O, V	1, 2, 3, 4, 5
<i>Crypturellus soui</i>	Little Tinamou	TF	O, V	1, 2, 3, 4, 5
<i>Crypturellus variegatus</i>	Variegated Tinamou	TF	S (MPEG 65102)	1
<b>ANATIDAE</b>				
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck	R	O	1, 4
<i>Cairina moschata</i>	Muscovy Duck	R	O	1, 5
<b>CRACIDAE</b>				
<i>Pauxi tuberosa</i>	Razor-billed Curassow	TF	O, I <sup>1</sup> , Recorded evidence (feathers)	1, 2, 3, 4
<i>Penelope pileata</i>	White-crested Guan	TF	O, P(WA436254)	
<i>Aburria cujubi</i>	Red-throated Piping-Guan	TF	O, S (MPEG 65593)	1, 3
<b>PHALACROCORACIDAE</b>				
<i>Phalacrocorax brasilianus</i>	Neotropic Cormorant	R	O	4
<b>ANHINGIDAE</b>				
<i>Anhinga anhinga</i>	Anhinga	R	O	1, 4
<b>ARDEIDAE</b>				
<i>Tigrisoma lineatum</i>	Rufescent Tiger-Heron	R	O	1, 4
<i>Cochlearius cochlearius</i>	Boat-billed Heron	R	I <sup>1</sup>	4
<i>Butorides striata</i>	Striated Heron	R	O	1, 3, 4, 5
<i>Pilherodius pileatus</i>	Capped Heron	R	O	1, 5
<i>Bubulcus ibis</i>	Cattle Egret	O, Pa	O, S (MPEG 65103)	3, 4
<i>Ardea alba</i>	Great Egret	R	O	2, 4
<i>Egretta thula</i>	Snowy Egret	R	O	2, 4
<i>Ardea cocoi</i>	Cocoi Heron	R	O	1, 4
<b>CATHARTIDAE</b>				
<i>Cathartes aura</i>	Turkey Vulture	ETF, O	O	2, 3, 4, 6

Family and Species	English Name	Habitat	Records Type	Sites
<i>Cathartes burrovianus</i>	Lesser Yellow-headed Vulture	ETF, O	O	1, 2, 3, 4, 6, 5, 7
<i>Coragyps atratus</i>	Black Vulture	O	O	1, 2, 3, 4, 6, 5, 7
<i>Sarcoramphus papa</i>	King Vulture	TF, O	O	1, 3
<b>ACCIPITRIDAE</b>				
<i>Elanoides forficatus</i>	Swallow-tailed Kite	TF, O	O	1, 2, 3, 4, 6, 7
<i>Ictinia plumbea</i>	Plumbeous Kite	EFR	O	1, 2, 3, 4, 6, 5, 7
<i>Geranospiza caerulescens</i>	Crane Hawk	TF	O	4
<i>Urubitinga urubitinga</i>	Great Black-Hawk	EFR	O	4
<i>Rupornis magnirostris</i>	Roadside Hawk	ETF,FR, O	O	1, 2, 3, 4, 6, 5, 7
<i>Buteo nitidus</i>	Gray Hawk	EFR, O	O	4
<i>Buteo brachyurus</i>	Short-tailed Hawk	O	O	6
<i>Harpia harpyja</i>	Harpy Eagle	TF	O	4
<i>Spizaetus tyrannus</i>	Black Hawk-Eagle	EFR	O	2
<i>Spizaetus ornatus</i>	Ornate Hawk-Eagle	TF	I <sup>1</sup>	4
<b>PSOPHIIDAE</b>				
<i>Psophia viridis</i>	Green-winged Trumpeter	TF	O	1, 3, 4
<b>RALLIDAE</b>				
<i>Aramides cajaneus</i>	Gray-necked Wood-Rail	TF	O	1, 2, 3, 4, 5
<b>EURYPYGIDAE</b>				
<i>Eurypyga helias</i>	Sunbittern	R	I <sup>1</sup>	1, 2, 4, 5
<b>CHARADRIIDAE</b>				
<i>Vanellus cayanus</i>	Pied Lapwing	R	O, S (MPEG 65595)	4
<i>Vanellus chilensis</i>	Southern Lapwing	O	O	4, 6, 5
<i>Charadrius collaris</i>	Collared Plover	P	O	6
<b>JACANIDAE</b>				
<i>Jacana jacana</i>	Wattled Jacana	R	O	4, 5
<b>STERNIDAE</b>				
<i>Sternula superciliaris</i>	Yellow-billed Tern	R	O	4
<b>COLUMBIDAE</b>				
<i>Columbina passerina</i>	Common Ground-Dove	O	O	1, 2, 3, 4, 6, 5, 7
<i>Columba livia</i>	Rock Pigeon	A	O	6
<i>Patagioenas speciosa</i>	Scaled Pigeon	ETF	O	3, 4, 5
<i>Patagioenas cayennensis</i>	Pale-vented Pigeon	TF	O	2, 3, 4, 5
<i>Leptotila verreauxi</i>	White-tipped Dove	TF	S (MPEG 65596)	4, 5
<i>Leptotila rufaxilla</i>	Gray-fronted Dove	TF	O	2, 3
<i>Geotrygon montana</i>	Ruddy Quail-Dove	TF	S (MPEG 65597)	1, 4, 5
<b>OPISTHOCOMIDAE</b>				
<i>Opisthocomus hoazin</i>	Hoatzin	R	O	1, 2, 4

Family and Species	English Name	Habitat	Records Type	Sites
<b>CUCULIDAE</b>				
<i>Piaya cayana</i>	Squirrel Cuckoo	TF	O	1, 2, 3, 4, 5
<i>Crotophaga major</i>	Greater Ani	R	O	1, 2, 4
<i>Crotophaga ani</i>	Smooth-billed Ani	ESR, O	O	2, 3, 4, 6, 5, 7
<i>Neomorphus squamiger</i>	Scaled Ground-Cuckoo	TF	O	1
<b>STRIGIDAE</b>				
<i>Megascops choliba</i>	Tropical Screech-Owl	ETF	V, O	1, 3
<i>Athene cunicularia</i>	Burrowing Owl	O	O	7
<b>NYCTIBIIDAE</b>				
<i>Nyctibius griseus</i>	Common Potoo	TF	V, O	1, 5
<b>CAPRIMULGIDAE</b>				
<i>Chordeiles nacunda</i>	Nacunda Nighthawk	O	O	6
<i>Hydropsalis albicollis</i>	Pauraque	ETF	V, O	1,2,3,4,6,5,7
<i>Hydropsalis nigrescens</i>	Blackish Nightjar	S	S (MPEG 65600)	4
<i>Hydropsalis torquata</i>	Scissor-tailed Nightjar	R	S (MPEG 65106)	2
<b>APODIDAE</b>				
<i>Chaetura brachyura</i>	Short-tailed Swift	AE	O	2, 3
<i>Tachornis squamata</i>	Fork-tailed Palm-Swift	AE	O	2, 3, 4, 5
<i>Cypseloides senex</i>	Great Dusky Swift	AE	O	4
<b>TROCHILIDAE</b>				
<i>Threnetes leucurus</i>	Pale-tailed Barbthroat	TF	S (MPEG 65604)	3
<i>Phaethornis ruber</i>	Reddish Hermit	TF	O, V	2, 5
<i>Phaethornis philippii</i>	Needle-billed Hermit	S, TF, ETF	S (MPEG 65104, 65605, 65606, 65607, 65110)	1, 2, 4, 5
<i>Phaethornis superciliosus</i>	Long-tailed Hermit	TF	S (65609, 65610)	1, 2, 3, 4, 5
<i>Phaethornis malaris</i>	Great-billed Hermit	TF	S (MPEG 65111)	3
<i>Campylopterus largipennis</i>	Gray-breasted Sabrewing	ESR	S (MPEG 65112)	3
<i>Florisuga mellivora</i>	White-necked Jacobin	ESR	O	3, 5
<i>Anthracothorax nigricollis</i>	Black-throated Mango	ETF	O	4
<i>Topaza pella</i>	Crimson Topaz	TF	S (MPEG 65603)	3
<i>Discosura langsdorffi</i>	Black-bellied Thorntail	ESR	O, P(WA784190)	3
<i>Discosura longicaudus</i>	Racket-tailed Coquette	ESR	S (MPEG 65602), P(WA784194)	3
<i>Thalurania furcata</i>	Fork-tailed Woodnymph	TF	S (MPEG 65611, 65612)	1, 2, 3, 5
<i>Hylocharis sapphirina</i>	Rufous-throated Sapphire	ESR	S (MPEG 65601) P(WA453732)	3
<i>Heliobryx auritus</i>	Black-eared Fairy	ETF	S (MPEG 65608)	5
<b>TROGONIDAE</b>				
<i>Trogon viridis</i>	White-tailed Trogon	EFR	O	2
<i>Trogon curucui</i>	Blue-crowned Trogon	EFR	O	1, 2

Family and Species	English Name	Habitat	Records Type	Sites
<i>Trogon violaceus</i>	Violaceous Trogon	TF	O	1, 4
<i>Trogon collaris</i>	Collared Trogon	TF	O	3
<i>Trogon rufus</i>	Black-throated Trogon	TF	O	2
<i>Trogon melanurus</i>	Black-tailed Trogon	TF	O	1
<b>ALCEDINIDAE</b>				
<i>Megaceryle torquata</i>	Ringed Kingfisher	R	O	1, 2, 4
<i>Chloroceryle amazona</i>	Amazon Kingfisher	R	O	1, 2, 4
<i>Chloroceryle aenea</i>	American Pygmy Kingfisher	R	O	1, 2, 4
<i>Chloroceryle americana</i>	Green Kingfisher	R	O	1, 2, 4
<i>Chloroceryle inda</i>	Green-and-rufous Kingfisher	TF	O	1
<b>MOMOTIDAE</b>				
<i>Electron platyrhynchum</i>	Broad-billed Motmot	EFR	O	1
<i>Baryphthengus martii</i>	Rufous Motmot	TF	S (MPEG 65594)	1, 3, 5
<i>Momotus momota</i>	Amazonian Motmot	TF	O	1
<b>GALBULIDAE</b>				
<i>Galbula dea</i>	Paradise Jacamar	FR	O	1, 2
<b>BUCCONIDAE</b>				
<i>Bucco tamatia</i>	Spotted Puffbird	TF	O, P (WA785084)	1
<i>Malacoptila rufa</i>	Rufous-necked Puffbird	TF	S (MPEG 65613)	1, 2, 5
<i>Monasa nigrifrons</i>	Black-fronted Nunbird	TF, FR	O	1, 2, 3, 4
<i>Monasa morphoeus</i>	White-fronted Nunbird	ETF	O	1, 3
<i>Chelidoptera tenebrosa</i>	Swallow-winged Puffbird	EFR	O	1, 2, 4, 6, 5, 7
<b>RAMPHASTIDAE</b>				
<i>Ramphastos tucanus</i>	White-throated Toucan	TF	O	1, 2, 3, 4, 6, 5, 7
<i>Ramphastos vitellinus</i>	Channel-billed Toucan	TF	O	1, 2, 3, 4, 6, 5, 7
<i>Pteroglossus inscriptus</i>	Lettered Aracari	EFR	O	4
<i>Pteroglossus aracari</i>	Black-necked Aracari	TF	O	1, 2, 3, 4, 5
<b>PICIDAE</b>				
<i>Picumnus aurifrons</i>	Bar-breasted Piculet	TF	S (MPEG 65113)	3
<i>Melanerpes cruentatus</i>	Yellow-tufted Woodpecker	ETF	O	1, 2, 3, 4
<i>Piculus flavigula</i>	Yellow-throated Woodpecker	TF	O	1
<i>Celeus grammicus</i>	Scaly-breasted Woodpecker	EFR	O	1
<i>Dryocopus lineatus</i>	Lineated Woodpecker	EFR	O	1, 2, 3, 4, 6, 5, 7
<i>Campephilus rubricollis</i>	Red-necked Woodpecker	ETF	O	2
<b>FALCONIDAE</b>				
<i>Daptrius ater</i>	Black Caracara	ETE, FR	O	2, 4, 6
<i>Ibycter americanus</i>	Red-throated Caracara	EFR	O	1, 4
<i>Milvago chimachima</i>	Yellow-headed Caracara	ETE, O	O	1



Family and Species	English Name	Habitat	Records Type	Sites
<i>Herpetotheres cachinnans</i>	Laughing Falcon	ETF, O	O	1, 3, 4, 5
<i>Falco ruficularis</i>	Bat Falcon	EFR	O	1, 4, 5
<b>PSITTACIDAE</b>				
<i>Ara ararauna</i>	Blue-and-yellow Macaw	TF	I <sup>1</sup>	1, 2, 3, 4, 6, 5, 7
<i>Ara macao</i>	Scarlet Macaw	TF	O	1, 2, 3, 4, 6, 5, 7
<i>Ara chloropterus</i>	Red-and-green Macaw	TF	I <sup>1</sup>	4
<i>Orthopsittaca manilatus</i>	Red-bellied Macaw	TF	O	1, 2, 3, 4, 6, 5, 7
<i>Guaruba guarouba</i>	Golden Parakeet	TF, FR	O	2, 3, 4, 6, 5, 7
<i>Psittacara leucophthalmus</i>	White-eyed Parakeet	TF, FR	O	6, 5
<i>Pyrrhura perlata</i>	Crimson-bellied Parakeet	EFR	O	1, 4
<i>Brotogeris versicolurus</i>	Canary-winged Parakeet	EFR	O	1, 4
<i>Brotogeris chrysoptera</i>	Golden-winged Parakeet	ETF	O	1, 4, 5
<i>Pyrilia aurantiocephala</i>	Bald Parrot	EFR	S (MPEG 65599)	2
<i>Amazona ochrocephala</i>	Yellow-crowned Parrot	EFR	O	4
<i>Amazona kawalli</i>	Kawall's Parrot	EFR	O	4
<i>Amazona amazonica</i>	Orange-winged Parrot	ESR	O	1, 4, 6, 5, 7
<i>Deroytus accipitrinus</i>	Red-fan Parrot	EFR	I <sup>1</sup>	4
<b>THAMNOPHILIDAE</b>				
<i>Epinecrophylla leucophthalma</i>	White-eyed Antwren	FR	S (MPEG 65127, 65128)	1
<i>Myrmotherula multistriata</i>	Amazonian Streaked-Antwren	TF	O, S (MPEG 65135)	2, 3
<i>Myrmotherula axillaris</i>	White-flanked Antwren	TF	S (MPEG 65625)	3
<i>Myrmotherula longipennis</i>	Long-winged Antwren	TF	S (MPEG 65622)	3
<i>Isleria hauxwelli</i>	Plain-throated Antwren	FR	O	1
<i>Thamnomanes saturninus</i>	Saturnine Antshrike	TF	O, S (MPEG 65125, 65126)	1, 2, 3, 4, 5
<i>Thamnomanes caesius</i>	Cinereous Antshrike	TF	O, S (MPEG 65124)	1, 2, 3, 4, 5
<i>Thamnophilus doliatus</i>	Barred Antshrike	ESR	O	2, 5
<i>Thamnophilus schistaceus</i>	Plain-winged Antshrike	TF	S (MPEG 65123)	2
<i>Thamnophilus aethiops</i>	White-shouldered Antshrike	TF	O	3
<i>Thamnophilus stictocephalus</i>	Natterer's Slaty-Antshrike	TF	O	1
<i>Thamnophilus amazonicus</i>	Amazonian Antshrike	TF	S (MPEG 65626)	1
<i>Myrmoderus ferrugineus</i>	Ferruginous-backed Antbird	TF	O, S (MPEG 65130)	1, 2, 5
<i>Hylophylax naevius</i>	Spot-backed Antbird	FR	O	1
<i>Myrmoborus myotherinus</i>	Black-faced Antbird	TF	O, S (MPEG 65129)	1, 2
<i>Hypocnemis striata</i>	Spix's Warbling-Antbird	TF	O, S (MPEG 65628)	1, 3, 5
<i>Willisornis poecilinotus</i>	Scale-backed Antbird	TF	S (MPEG 65132)	1, 2, 3, 5
<i>Phlegopsis nigromaculata</i>	Black-spotted Bare-eye	TF	O, S (MPEG 65133)	1, 2, 3, 5
<i>Phlegopsis borbae</i>	Pale-faced Antbird	TF	S (MPEG 65631, 65632)	3
<i>Rhegmatorhina berlepschi</i>	Harlequin Antbird	TF	S (MPEG 65131, 65134)	1, 2, 3, 5

Family and Species	English Name	Habitat	Records Type	Sites
<b>FORMICARIIDAE</b>				
<i>Formicarius analis</i>	Black-faced Antthrush	TF	O	1, 2, 3, 5
<b>DENDROCOLAPTIDAE</b>				
<i>Dendrocincla fuliginosa</i>	Plain-brown Woodcreeper	TF	S (MPEG 65115, 65116, 65615)	1, 4
<i>Dendrocincla merula</i>	White-chinned Woodcreeper	TF	S (MPEG 65614)	3
<i>Deconychura longicauda</i>	Long-tailed Woodcreeper	TF	S (MPEG 65616)	1
<i>Certhiasomus stictolaemus</i>	Spot-throated Woodcreeper	TF	S (MPEG 65617)	1, 3
<i>Glyphorhynchus spirurus</i>	Wedge-billed Woodcreeper	TF	S (MPEG 65121)	1, 2, 3, 4, 5
<i>Dendrocolaptes hoffmannsi</i>	Hoffmanns's Woodcreeper	TF	S (MPEG 65117)	1, 3
<i>Xiphorhynchus ocellatus</i>	Ocellated Woodcreeper	FR	S (MPEG 65119)	1
<i>Xiphorhynchus elegans</i>	Elegant Woodcreeper	TF	S (MPEG 65120)	1, 2
<i>Xiphorhynchus guttatus</i>	Buff-throated Woodcreeper	FR	S (MPEG 65118)	1, 2, 3, 4, 5
<b>XENOPIIDAE</b>				
<i>Xenops tenuirostris</i>	Slender-billed Xenops	FR	O	1
<i>Xenops minutus</i>	Plain Xenops	FR	O	1
<b>FURNARIIDAE</b>				
<i>Philydor pyrrhodes</i>	Cinnamon-rumped Foliage-gleaner	FR	S (MPEG 65122)	1, 2
<i>Philydor erythropterum</i>	Chestnut-winged Foliage-gleaner	FR	O	1
<i>Automolus paraensis</i>	Para Foliage-gleaner	FR	S (MPEG 65620)	1, 2, 3
<i>Automolus ochrolaemus</i>	Buff-throated Foliage-gleaner	FR	O	2
<i>Synallaxis gujanensis</i>	Plain-crowned Spinetail	EFR	S (MPEG 65621)	4
<b>PIPRIDAE</b>				
<i>Pipra fasciicauda</i>	Band-tailed Manakin	FR	S (MPEG 65152)	2, 3
<i>Ceratopipra rubrocapilla</i>	Red-headed Manakin	FR	O, S (MPEG 65645, 65153)	1, 2, 3, 4
<i>Lepidothrix nattereri</i>	Snow-capped Manakin	FR	S (MPEG 65149, 65150, 65151)	1, 3, 4
<i>Manacus manacus</i>	White-bearded Manakin	S,	S (MPEG 65148)	4
<i>Heterocercus linteatus</i>	Flame-crowned Manakin	FR, S	O, S (MPEG 65158), P(WA784186)	2, 4, 6
<i>Chiroxiphia pareola</i>	Blue-backed Manakin	FR	S (MPEG 65644)	1
<b>ONYCHORHYNCHIDAE</b>				
<i>Onychorhynchus coronatus</i>	Royal Flycatcher	FR	O	2, 5
<i>Myiobius barbatus</i>	Whiskered Flycatcher	FR	S (MPEG 65634)	3, 4
<b>TITYRIDAE</b>				
<i>Laniocera hypopyrra</i>	Cinereous Mourner	FR	S (MPEG 65154)	4
<i>Tityra inquisitor</i>	Black-crowned Tityra	S	S (MPEG 65642)	4
<i>Tityra cayana</i>	Black-tailed Tityra	TF, S	O, S (MPEG 65641)	1, 2, 3, 4, 6, 5. 7
<i>Tityra semifasciata</i>	Masked Tityra	EFR	O	4

Family and Species	English Name	Habitat	Records Type	Sites
<b>COTINGIDAE</b>				
<i>Lipaugus vociferans</i>	Screaming Piha	TF,FR	O, V	1, 2, 3, 4, 5
<i>Xipholena lamellipennis</i>	White-tailed Cotinga	FR	O	3
<i>Gymnoderus foetidus</i>	Bare-necked Fruitcrow	FR	O	2
<b>TYRANNIDAE</b>				
<i>Mionectes oleagineus</i>	Ochre-bellied Flycatcher	FR	O, S (MPEG 65146)	1, 2, 3, 4
<i>Mionectes macconnelli</i>	McConnell's Flycatcher	S	S (MPEG 65638, 65639)	4
<i>Hemitriccus minor</i>	Snethlage's Tody-Tyrant	FR	S (MPEG 65145)	1
<i>Myiopagis gaimardii</i>	Forest Elaenia	ESR	S (MPEG 65635)	3, 5
<i>Elaenia parvirostris</i>	Small-billed Elaenia	EFR	S (MPEG 65139)	4
<i>Elaenia spectabilis</i>	Large Elaenia	ESR	S (MPEG 65142)	3
<i>Tolmomyias flaviventris</i>	Yellow-breasted Flycatcher	ESR	S (MPEG 65636, 65637, 65140, 65141)	3, 4
<i>Tolmomyias poliocephalus</i>	Gray-crowned Flycatcher	ESR	S (MPEG 65633)	3
<i>Lathrotriccus euleri</i>	Euler's Flycatcher	ESR	O	6
<i>Legatus leucophaeus</i>	Piratic Flycatcher	ESR	O, S (MPEG 65144)	1, 2, 3, 4, 6
<i>Myiozetetes cayanensis</i>	Rusty-margined Flycatcher	ETF	O	1, 2, 3, 4, 6, 5, 7
<i>Pitangus sulphuratus</i>	Great Kiskadee	ETF	O	1, 2, 3, 4, 6, 5, 7
<i>Myiodynastes maculatus</i>	Streaked Flycatcher	ETF	O	2, 6
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher	EFR	O	1, 2, 3, 4, 6, 5, 7
<i>Empidonomus varius</i>	Variiegated Flycatcher	EFR	O, P(WA454249)	3, 6
<i>Tyrannus melancholicus</i>	Tropical Kingbird	EFR	O	1, 2, 3, 4, 6, 5, 7
<i>Myiarchus ferox</i>	Short-crested Flycatcher	EFR	O, S (MPEG 65640)	1, 2, 3, 4, 6, 5, 7
<i>Attila spadiceus</i>	Bright-rumped Attila	FR	O, S (MPEG 65137)	2, 3
<b>VIREONIDAE</b>				
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	EFR	O, V	1, 2, 3, 4, 6
<i>Vireo olivaceus</i>	Red-eyed Vireo	ESR	S (MPEG 65647)	6
<i>Hylophilus semicinereus</i>	Gray-chested Greenlet	ESR	S (MPEG 65648)	6
<i>Hylophilus ochraceiceps</i>	Tawny-crowned Greenlet	FR	S (MPEG 65160)	1
<b>HIRUNDINIDAE</b>				
<i>Tachycineta albiventer</i>	White-winged Swallow	R	O	1, 2, 4
<i>Progne tapera</i>	Brown-chested Martin	O	O	4, 6
<i>Progne chalybea</i>	Gray-breasted Martin	O, A	O	4, 6, 5, 7
<i>Atticora fasciata</i>	White-banded Swallow	R	O, S (MPEG 65162)	1, 2, 4, 5
<b>TROGLODYTIDAE</b>				
<i>Microcerculus marginatus</i>	Scaly-breasted Wren	TF	S (MPEG 65155)	1
<i>Troglodytes musculus</i>	Southern House Wren	A, O	O	2, 6
<i>Campylorhynchus turdinus</i>	Thrush-like Wren	EFR	O	1, 2, 3, 4, 5
<i>Pheugopedius genibarbis</i>	Moustached Wren	ESR	O, S (MPEG 65156)	2, 5

Family and Species	English Name	Habitat	Records Type	Sites
<i>Cantorchilus leucotis</i>	Buff-breasted Wren	S	S (MPEG 65157)	4
<b>TURDIDAE</b>				
<i>Turdus fumigatus</i>	Cocoa Thrush	EFR	S (MPEG 65654)	1, 4
<i>Turdus lawrencii</i>	Lawrence's Thrush	FR	O, V	1
<i>Turdus albicollis</i>	White-necked Thrush	TF	S (MPEG 65655)	3, 5
<b>PASSERELLIDAE</b>				
<i>Ammodramus aurifrons</i>	Yellow-browed Sparrow	O	O	2, 3, 4, 6, 5, 7
<i>Arremon taciturnus</i>	Pectoral Sparrow	S	S (MPEG 65168, 65656)	3, 4
<b>PARULIDAE</b>				
<i>Myiothlypis rivularis</i>	Neotropical River Warbler	FR	S (MPEG 65161)	1
<b>ICTERIDAE</b>				
<i>Psarocolius viridis</i>	Green Oropendola	EFR, FR	O	3, 4
<i>Icterus cayanensis</i>	Epulet Oriole	EFR, FR	O	5
<i>Cacicus cela</i>	Yellow-rumped Cacique	EFR	O	1, 2, 3, 4, 6, 5, 7
<i>Molothrus oryzivorus</i>	Bobolink	R	O	4
<i>Molothrus bonariensis</i>	Shiny Cowbird	EFR	S (MPEG 65662)	2, 4
<i>Sturnella militaris</i>	Red-breasted Blackbird	O	S (MPEG 65169)	4, 5, 7
<b>THRAUPIDAE</b>				
<i>Saltator grossus</i>	Slate-colored Grosbeak	ESR	O	2
<i>Saltator maximus</i>	Buff-throated Saltator	EFR	O	2, 3, 4
<i>Habia rubica</i>	Red-crowned Ant-Tanager	TF	S (MPEG 65657)	1
<i>Lanio cristatus</i>	Flame-crested Tanager	TF	S (MPEG 65653)	1
<i>Lanio surinamus</i>	Fulvous-crested Tanager	EFR	O	3
<i>Tachyphonus rufus</i>	White-lined Tanager	EFR	O, S (MPEG 65164, 65165, 65166)	2, 4, 6, 5, 7
<i>Tachyphonus phoenicius</i>	Red-shouldered Tanager	S	S (MPEG 65159)	4
<i>Ramphocelus carbo</i>	Silver-beaked Tanager	EFR	O, S (MPEG 65658)	1, 2, 3, 4, 6, 5, 7
<i>Tangara episcopus</i>	Blue-gray Tanager	EFR	O	1, 2, 3, 4, 6, 5, 7
<i>Tangara palmarum</i>	Palm Tanager	EFR	O	1, 2, 3, 4, 6, 5, 7
<i>Tangara chilensis</i>	Paradise Tanager	TF	O	3
<i>Tangara schrankii</i>	Green-and-gold Tanager	FR	O, P(WA784182)	2
<i>Dacnis lineata</i>	Black-faced Dacnis	TF, ESR	S (MPEG 65178, 65179)	3
<i>Dacnis cayana</i>	Blue Dacnis	TF, ESR	S (MPEG 65177)	3
<i>Cyanerpes nitidus</i>	Short-billed Honeycreeper	TF, ESR	S (MPEG 65170, 65171, 65172, 65173, 65174)	3
<i>Cyanerpes caeruleus</i>	Purple Honeycreeper	TF, ESR	S (MPEG 65175, 65176)	3
<i>Volatinia jacarina</i>	Blue-black Grassquit	ESR	O	4, 6, 5, 7
<i>Sporophila americana</i>	Wing-barred Seedeater	O	S (MPEG 65167, 65663), P(WA453727)	4

Family and Species	English Name	Habitat	Records Type	Sites
<i>Sporophila nigricollis</i>	Yellow-bellied Seedeater	ESR	O, S (MPEG 65664, 65666)	3, 6
<i>Sporophila castaneiventris</i>	Chestnut-bellied Seedeater	O	O	4, 6, 5, 7
<i>Sporophila angolensis</i>	Chestnut-bellied Seed-Finch	O	O, S (MPEG 65665)	2, 3, 4
<i>Paroaria gularis</i>	Red-capped Cardinal	R	O	1, 2, 4, 5
<b>CARDINALIDAE</b>				
<i>Caryothraustes canadensis</i>	Yellow-green Grosbeak	S	S (MPEG 65660)	4
<i>Cyanoloxia rothschildii</i>	Rothschild's Blue Grosbeak	TF	O	1, 3, 4
<b>FRINGILIDAE</b>				
<i>Euphonia xanthogaster</i>	Orange-bellied Euphonia	TF	S (MPEG 65667)	3

<sup>1</sup> - Refers to interviews with local residents (at each sampling point) on the occurrence of some bird species in the Amana National Forest.