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The brazilian Caatinga biome where the Pankararu indigenous live

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ABSTRACT

This paper is a photographic summary of studies carried out in July-August 2012 in Pankararu indigenous territories, located in the Pernambuco State, Brazil, in the Caatinga biome. A scientific expedition was carried out to analyze the environmental impacts of a project in the region and more specifically the possible interferences in the life of the indigenous inhabitants of the region and live in harmony with the environment. The photos show some structures of indigenous villages, important geological formations in the Pankararu territory, the Caatinga where studies were carried out and some of the bird species registered.

Keywords: Pankararu indigenous, Caatinga, biomes in Brazil

INTRODUCTION

Caatinga is a type of subtropical vegetation, and an ecoregion characterized by this vegetation in interior northeastern Brazil. The name "Caatinga" is a Tupi (indigenous language) word meaning "white vegetation" (caa = vegetation, tinga = white). Why this name? Because during the dry season most plants lose their leaves, the clear and whitish appearance of tree trunks prevails in the landscape.

Plantlife in the Caatinga comprises scrub trees that remain dry almost all year round. Many species of plants have spines, like cactuses, their leaves have evolved into spines so less water gets lost through transpiration. Succulent species dominate, non-succulents exhibit small, firm leaves and intense branching at the base, akin to shrubs [1-4] (Photos 63-68). Most vegetation experiences a brief burst of activity during the three-month-long rainy season (Photo 77).

The average rainfall in the Caatinga varies between 400 and 800 mm/year and can be lower than 300 mm/year in drier areas [5]. Despite this low rainfall, about twenty-eight million people occupy the Caatinga, making it the most populous semi-arid area on the planet.

During the dry periods, there is no foliage or undergrowth, as plants try to conserve water. Leaves fall off the trees to reduce transpiration. With all the foliage and undergrowth dead during the drought periods and all the trees having no leaves, the Caatinga has a yellow-grey, desert-like look. Therefore, Caatinga vegetation seems lifeless, lacking leaves and color, just a lot of dried-up, twisted stalks and trunks [6-8].

But these plants are still alive, some using their well-developed root systems to reach water stored in the ground. Other species have developed roots that run across the ground, allowing them to absorb as much surface water as possible when the rains come. Other species have solved the problem in another way, by storing the water themselves: this is what cactuses do [9-16].

Immediately after the first rains, the grey, desert-like landscape starts to transform and becomes completely green within a few days. Small plants start growing in the now moist soil and trees grow back their leaves. Rivers that are mostly dry during the past 6 or 7 months start to fill up and streams begin to flow again [17] (Photos 53-58).

Cactuses are fine representatives of the caatinga but not the only ones. Even though the period of rains is brief, the caatinga has a variety of plant species, including the mandacaru

cactus (*Cereus jamaru*); the coroa-de-frade melon cactus (*Melocactus* spp); the xique-xique cactus (*Pilosocereus* spp); trees known as the juazeiro (*Ziziphus joazeiro*), braúna (*Schinopsis brasiliensis*) and umbuzeiro (*Spondias tuberosa*) [18, 19] (Photos 63-76).

Caatinga falls entirely within the earth's tropical zone and is one of the 6 major ecoregions of Brazil. It covers 912,529 km², which corresponds to 11,7% of Brazil's territory. By comparison, it is almost three times the surface area of Poland (Figure 1).

The Caatinga is the only exclusively Brazilian biome, which means that a large part of its biological heritage cannot be found anywhere else on the planet [20]. It is poorly represented in the Brazilian Conservation Area network. Economic development has fragmented the native biome. Estimates on the amount of Caatinga transformed affected by economic development range 25-50%, making Caatinga the most degraded ecosystem in Brazil, following the Atlantic Forest, which has lost over 80% of its original cover [21, 22].



Figure 1. Map of the distribution of biomes in Brazil, according to IBGE [23]. The red circle indicates the approximate area where the study was carried.

Caatinga harbors a unique biota, with thousands of endemic species. It contains over 1,000 vascular plant species in addition to 221 bees species, 241 fish species, 177 reptiles species, 79 amphibian species, 591 birds species, and 178 mammal species [24-49]. Among the

lizards *Tropidurus hispidus* is a species that is widely distributed in Brazil. It is commonly known in Northeast Brazil as “catende” (Photo 81), and *Tropidurus semitaeniatus* (Photo 82), a lizard species endemic to the Caatinga. Some birds are typical caatinga residents, like the Picazuro Pigeon, Cactus Parakeet, Tropical Gnatcatcher, Campo Troupial, Red-cowled Cardinal, among others (Photos 83-116).



Figure 2. Localization of the studied Pankararu Indigenous Territories.

The main objective of this scientific expedition was to detect the possible risks of impacts on the lives of the Pankararu indigenous, due to the passage of an electric power transmission line close to the territories occupied by the indigenous. The study was carried out in the Pankararu Indigenous Territories, in July-August 2012. The studied territories are located in the Pernambuco State, Brazil.

The Pankararu indigenous lands are located between the current municipalities of Petrolândia, Itaparica, Tacaratu and Jatobá, in the sertão ("hinterland") of Pernambuco, near the São Francisco River. The Pankararu territories in this region comprise three localities: Pankararu, Entre Serras and Pankaiwká/Cristo Rei, organized in twelve villages. They are situated between 9°02'S to 9°17'S latitude and 38°06'W to 38°16'W longitude (Figure 2).

Pankararu locality is older, and its shape is that of a perfect square and it corresponds to the memory that Pankararu maintains of the imperial donation of a land grant to the religious mission that settled their ancestors, during the eighteenth and nineteenth centuries. The Pankaiwká/Cristo Rei locality is a nucleus of Pankararu remnants that assumed the ethnonym Pankaiwká (Photos 1-27, 77-80).

A small swamp, formed by an opening amid the last foothills of the Tacaratu Sierra, better known by locals as Serra da Fonte Grande (Photo 1), takes the form of an amphitheater, with its waterheads to the east, opening up westward toward the shores of the São Francisco River. This little "green oasis", in which the village of Brejo dos Padres was placed (Photo 2), stands deep in the hinterland area and contrasts with the landscape around, marked by extensive animal farming and, until the middle of the twentieth century, generally not significant subsistence agriculture.

In the central section of the indigenous land is found a rather moist, dark earth, which is fed by four water sources. In this area, the soil quality allows planting everything, from corn and various kinds of beans to sugar cane.

In the southern section, the mountain slopes down at once, in broad contours that form natural pastures. Two water sources hydrate a narrow stretch of this section, dampening the small depression. In this watered part, which comprises about a third of the entire section, beans and corn are planted, leaving the remaining two-thirds of slopes for planting cassava. The importance of this region for the Pankararu is its role as, not only a timber reserve but also the place where the umbu (*Spondias tuberosa*), native to the region, flowers. Its fruit is almost an ethnic symbol, playing a main part in their festivals' mythology [50].

In the southern section, the land is mostly used for grazing but there are parts, especially those near the springs, where are the villages of Tapera (Photos 13, 16) and Carrapateira (Photos 14, 15), that have shown to be good for planting.

Native plants are used in local agriculture, much of it slash-and-burn. Many plant species are used by the Pankararu in medicine. The fruits of umbu (*Spondias tuberosa*) and mangaba (*Hancornia speciosa*) are used as food directly, and other species are used for forage [51-53]. In addition to the innumerable reasons for the conservation of the Caatinga, based on the preservation of genetic diversity and its importance for other natural resources such as soil, water, and fauna, the extractivist value of this ecosystem is especially crucial [54, 55].

The Pankararu live in balance with the environment wherein which they live. They use natural resources to build their homes, such as timber for the structure (Photos 28-34). The Pankararu economic system is characterized by a combination of the activities of gathering, hunting, fishing, and agriculture. They mainly grow cassava and corn, which are the basis of their food (Photos 35-52, 59, 60).

The planting system used by the Pankararu called locally "roça" or "coivara", is well known in the interior of Brazil and represents an authentic heritage of the Amerindians themselves. The slash-and-burn agricultural method is based on the felling and burning of the forest followed by planting, and then rotation into fallow to restore the soil fertility over rest periods that can vary from a minimum of four years up to twenty years (Photo 43). The restoration of soil conditions is linked to the nutrient inputs and the inexistence of severe processes of erosion and is influenced by the proximity from the source of native species and the soils' seed bank.

All photos presented in this report were realized by Fabio Rossano Dario, using a digital photo camera Canon PowerShot.

CONCLUSIONS

The Caatinga hosts an extraordinary variety of species, some endemic, others endangered, and many of which are still unknown. However, this region has experienced a continuing increase in anthropogenic pressures, mainly from deforestation, which implies a strong concern for the conservation of the biota of this region, and the security of indigenous communities who live in it.

The indigenous knowledge about the ecological interactions between travels through generations from older to younger ones in oral transmission. The relationships established between the Pankararu with the environment in which they live are complex, showing a mythical interaction between man and the elements of nature. They respect the rivers, the forest, and all the living beings that live in it.

The Pankararu indigenous have a rich culture, and they are very gentle and cultured people. They received the research team with great affection and taught us many things about the environment in which they live (Photos 61, 62).

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Photo 1. In the background to observe the “Serra da Fonte Grande”, an important geological formation in the Pankararu territory.



Photo 2. Brejo dos Padres village, located in the Pankararu territory.



Photo 3. In the background to observe the “Serra da Tapera”, an important geological formation in the Pankararu territory.



Photo 4. In the background to observe the “Serra da Tapera”, an important geological formation in the Pankararu territory.



Photo 5. In the background to observe the “Serra da Tapera”, an important geological formation in the Pankararu territory.



Photo 6. The area used for farming, known as “roça” in the Pankararu territory.



Photo 7. An important geological formation in the Pankararu territory “Entre Serras”.



Photo 8. Pankararu territory “Entre Serras”.

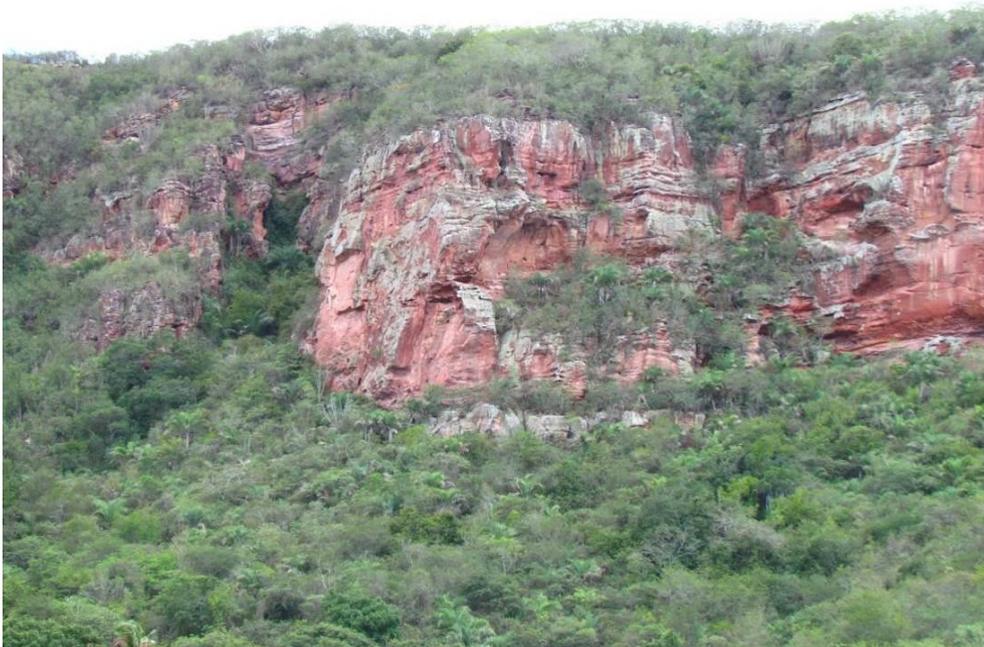


Photo 9. An important geological formation in the Pankararu territory “Entre Serras”.

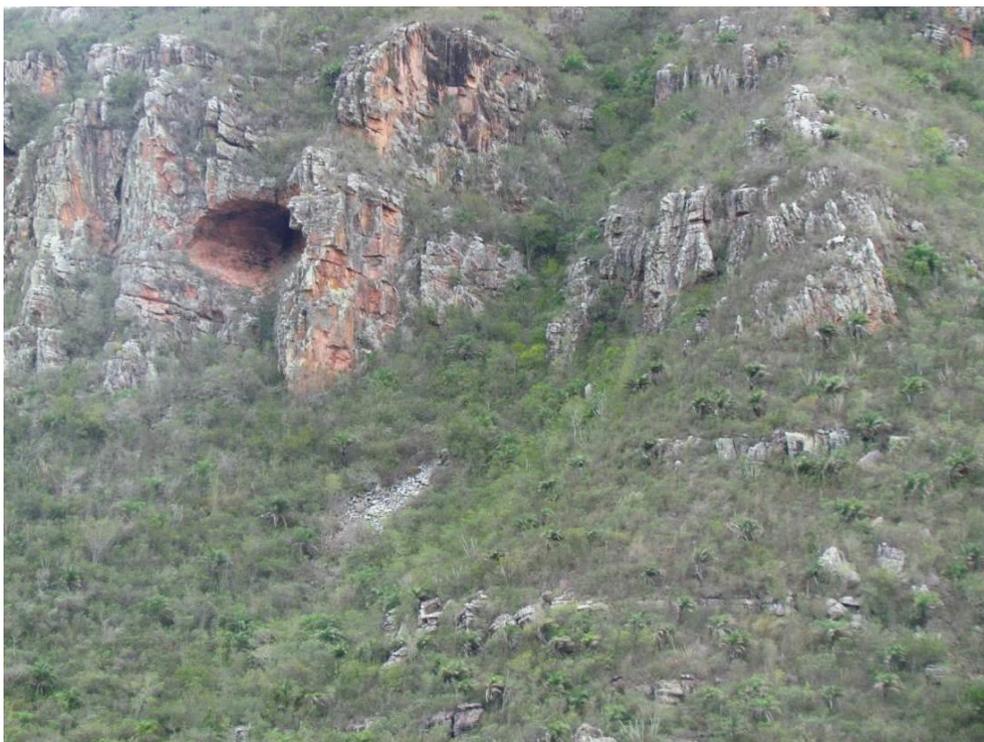


Photo 10. Detail of the geological formation present in the Pankararu territory “Entre Serras”.



Photo 11. Rock outcrops are very common in the Pankararu territories.



Photo 12. Road in Carrapateira village.



Photo 13. St. Joseph's Church, in Tapera village.



Photo 14. Indigenous school in Carrapateira village.



Photo 15. Cassava “flour house” in Carrapateira village.



Photo 16. Ambulatory in Tapera village.



Photo 17. House in Brejo dos Padres village.



Photo 18. Caxiado village.



Photo 19. Cassava “flour house” in Entre Serras village.



Photo 20. Mundo Novo village.



Photo 21. Mundo Novo village.



Photo 22. Mundo Novo village.



Photo 23. Mundo Novo village.



Photo 24. Mundo Novo village.



Photo 25. The artisan Zé Cocada and his atelier in Tapera village.



Photo 26. Atelier of the Pankararu artisan Zé Cocada in Tapera village.



Photo 27. Ceramic pieces made by artisan Zé Cocada.



Photo 28. Pankaiwká village.



Photo 29. The wattle and daub house (casa de pau-a-pique) is a traditional Brazilian handmade clay house, with mud and tree trunks, sticks, wood.



Photo 30. This method of construction is using a woven lattice of wooden strips that is daubed with a sticky material usually made of some combination of wet soil, clay, sand, animal dung, and straw.



Photo 31. This traditional Brazilian handmade clay house has a low-impact sustainable construction technique.



Photo 32. Detail of a cistern used for catching and storing rainwater



Photo 33. Fence built with branches in Pankaiwká village.



Photoc 34. Fene built with branches in Pankaiwká village.



Photo 35. The tillage with the moldboard plow (aiveca) is still common in the Pankararu territory.



Photo 36. Area used for farming, known as “roça”.



Photo 37. Corn (*Zea mays*) is an important food cultivated by the Pankararu.



Photo 38. Manioc (*Manihot esculenta*), known in Brazil as “mandioca”, “macaxeira” or “aipim”, is a root crop that is cultivated by many indigenous groups in Brazil. It is an important subsistence crop for many traditional populations.



Photo 39. Area cultivated with beans. It is an important subsistence crop for many traditional populations in Brazil.



Photo 40. Detail of bean seedlings.



Photo 41. The cactus known as "palma" (*Opuntia* spp) is cultivated and used in cattle feed and eventually as human food.



Photo 42. The sugarcane (*Saccharum officinarum*) is a plant cultivated by the Pankararu, primarily for its juice from which sugar is processed.



Photo 43. The “coivara”, also known as shifting cultivation is an agricultural system that depends on the slashing and burning of forest cover to open cultivation plots.



Photo 44. Detail of indigenous people plowing the land with a moldboard plow (aiveca).



Photo 45. The indigenous knowledge abounds and is the basis for agricultural practices.



Photo 46. Indigenous peoples can contribute significantly to the family farming debate thanks to their wealth of traditional knowledge, spirituality, and understanding.



Photo 47. The Pankararu mainly grow cassava, bean, and corn, which are the basis of their food.



Photo 48. The people of the caatinga are very hardworking.



Photo 49. Herd of goats.



Photo 50. When rain does fall, the Caatinga is transformed: the landscape turns green.



Photo 51. Pigs are used as food in the Caatinga.



Photo 52. Herd of goats.



Photo 53. Dry weir located in the Carrapateira village. In the background to observe the “Serra da Tapera”, an important geological formation in the Pankararu territory.



Photo 54. The “Lagoa da Vassoura” is a pond that remains dry most of the year.



Photo 55. Since rain is scarce in the Caatinga throughout most of the year, the rivers and then ponds remain dry for long periods.



Photo 56. Most of the rivers in the Brazilian caatinga are intermittent or temporary. This means they simply vanish during dry periods.



Photo 57. The watercourses dry up during certain periods in the Caatinga.



Photo 58. The caatinga has a semi-arid climate, characterized by low humidity and low rainfall.



Photo 59. “Sertanejo” is a generic name to designate that who lives in the “sertão” (interior of the Caatinga).



Photo 60. The donkey, whose popular name in Brazil is “jumento” or “jegue”, is a domestic animal in the horse family, widely used in the caatinga as a pack animal.



Photo 61. In the company of a dear Pankararu friend.



Photo 62. The Pankararu indigenous have a rich culture, and they are very gentle and cultured people.



Photo 63. Xique-xique cactus (*Pilosocereus* spp).



Photo 64. Cactuses are fine representatives of the Caatinga.



Photo 65. Mandacaru cactus (*Cereus jamacaru*).



Photo 66. *Melocactus* (melon cactus) is a genus of cactus with about 30-40 species, with a concentration of species in northeastern Brazil.



Photo 67. The flora of the Caatinga is made up of xerophytes. These species have developed ways of surviving where rainfall is scarce and the humidity low.



Photo 68. The Caatinga is the predominant vegetation in the Pankararu territory.



Photo 69. *Schinopsis brasiliensis* (Anacardiaceae), commonly known as "braúna", is a typical "Caatinga" tree.



Photo 70. *Pilosocereus pachycladus* known as "facheiro" is a common cactus in the Caatinga biome in Brazil.



Photo 71. The “xique-xique” (*Pilosocereus gounellei*) is a common cactus in the Caatinga biome in Brazil, developing very well in the drier areas.



Photo 72. The "croá" (*Neoglaziovia variegata*) is a species of bromeliad of fundamental importance for Pankararu because it provides a fiber that is used to produce garments of the “Praiás” as well as skirts for the ritual of “Toré”.



Photo 73. “Faveleira” (*Cnidoscolus phyllacanthus*), a typical caatinga tree species, is very important in Pankararu medicine.



Photo 74. Flowers of the Golden Trumpet Tree (*Handroanthus chrysotrichus*). It is a tree native to Brazil, where it is known as "ipê-amarelo".



Photo 75. *Syagrus coronata*, commonly known as licuri palm, is a species of palm tree that plays an important role in the diets of caatinga animals and for various uses by the Pankararu.



Photo 76. This bush species, popularly known in Brazil as "pinhão" (*Jatropha pohliana*) is very used in folk medicine and among the Pankararu.



Photo 77. When rain does fall, the Caatinga is transformed: the landscape turns green.



Photo 78. Rock paintings in the Caatinga of the Pankararu.



Photo 79. The lichens are an important element of the biodiversity of the Caatinga.



Photo 80. Some lichens species are used in traditional medicine by the Pankararu.



Photo 81. *Tropidurus hispidus* is a lizard species that are widely distributed in Brazil. It is commonly known in Northeast Brazil as “catende”.



Photo 82. *Tropidurus semitaeniatus* is a lizard species endemic to the Caatinga, where they live in syntropy with the *Tropidurus hispidus* (Photo 81), which is distributed in other ecosystems and biomes.



Photo 83. *Bubulcus ibis* (Cattle Egret). This egret is very popular in Brazil, and its diet is essentially insectivorous.



Photo 84. *Rupornis magnirostris* (Roadside Hawk). This is the most common hawk found in anthropic areas like rural zones, pastures, cities, road edges, savannas, and caatingas.



Photo 85. *Vanellus chilensis* (Southern Lapwing) is a conspicuous and noisy bird. Its name in Portuguese is “quero-quero” (this is an onomatopoeic word, that is, a word whose pronunciation imitates the sound it describes).



Photo 86. Unlike most owls, Burrowing Owls (*Athene cunicularia*) are often active during the day. It can be found in grasslands, pastures, agricultural fields, and urban vacant lots. It eats invertebrates, especially insects as grasshoppers, crickets, moths, and beetles.



Photo 87. *Columbina picui* (Picui Ground-Dove) is a bird that belongs to the family of pigeons.



Photo 88. *Patagioenas picazuro* (Picazuro Pigeon). Its name in Portuguese is “asa-branca”. It forages for seeds on the ground and in plantations.



Photo 89. The Guira Cuckoo (*Guira guira*) is an opportunistic predator, gathering small prey items on the ground or searching for them among branches. This is a very gregarious species, always found in noisy groups.



Photo 90. *Chlorostilbon lucidus* (Glittering-bellied Emerald). It is a common hummingbird found in eastern Brazil. It consumes nectar from flowers and eats insects to add proteins and minerals to its diet.



Photo 91. *Galbula ruficauda*, ♂ (Rufous-tailed Jacamar). This insectivore hunts from a perch, sitting with its bill tilted up, then flying out to catch flying insects.



Photo 92. The Green-barred Woodpecker ♀ (*Colaptes melanochloros*) is a species of bird in the woodpecker family. It is found in a wide range of open and semi-open habitats.



Photo 93. *Caracara plancus* (Southern Caracara). This species is common in open or partly open areas, such as grasslands, cultivated fields, swamplands, road edges, cities, and rural zones.



Photo 94. *Milvago chimachima* (Yellow-headed Caracara). It is omnivorous and will eat reptiles, amphibians, and other small animals as well as carrion.



Photo 95. *Falco sparverius*, ♀ (American Kestrel). This is a small falcon found in open areas. It lives in savannas, caatingas, grasslands, pastures, rural zones, cities, swamplands, and on the borders of dry forests, shores, and cultivated fields.



Photo 96. Turquoise-fronted Parrot (*Amazona aestiva*) is one of the most common Brazilian parrots kept in captivity as a pet.



Photo 97. *Eupsittula cactorum* (Cactus Parakeet) is endemic to the Caatinga. It appreciates seeds, fruits, and flowers, especially those from certain cactus plants, which are common in their domain like *Pilosocereus pachycladus* (in the photo).



Photo 98. Wing-banded Hornero (*Furnarius figulus*) feeds on insects. Its natural habitats include a wide range of wooded habitats, especially near water and around mudflats.



Photo 99. Southern Beardless-Tyrannulet (*Camptostoma obsoletum*) is a small passerine bird in the tyrant flycatcher family.



Photo 100. Brown-crested Flycatcher (*Myiarchus Tyrannulus*) is a fairly large flycatcher with a large, hooked bill. It is conspicuous and aggressive in the nesting season.



Photo 101. Great Kiskadee (*Pitangus sulphuratus*) is probably one of the best-known birds in Brazil. It is audacious, has little fear of humans and its song is loud and marked. Its name in Portuguese is “ben-te-vi” (this is an onomatopoeic word).



Photo 102. Cattle Tyrant (*Machetornis rixosa*) is a species of bird in the tyrant-flycatcher family Tyrannidae.



Photo 103. White-throated Kingbird (*Tyrannus melancholicus*) is a large flycatcher that occupies a variety of habitats, from forest edges to open areas and pastures, to woodlands and urban areas.



Photo 104. Masked Water-Tyrant (*Fluvicola nengeta*) is a medium-sized terrestrial flycatcher, usually encountered near water and frequently found in urban areas where it can be quite tame.



Photo 105. White-naped Jay (*Cyanocorax cyanopogon*) is a species of bird in the family Corvidae. It inhabits deciduous woodland, dense cerrado, and caatinga.



Photo 106. Tropical Gnatcatcher (*Polioptila plumbea*, ♂) is a small active insectivorous songbird, which is a species found from north-eastern Brazil (the Caatinga region).



Photo 107. The Chalk-browed Mockingbird (*Mimus saturninus*) is a bird that feeds on fruits, insects, and small vertebrates. The song of this bird is loud, a "varied series of notes, and trills". It often mimics other species including some raptors.



Photo 108. Yellowish Pipit (*Anthus lutescens*) is a species of bird in the family Motacillidae.



Photo 109. Rufous-collared Sparrow (*Zonotrichia capensis*) is found in a wide range of habitats, often near humans. It feeds on the ground on seeds, fallen grain, insects, and spiders. It will sometimes join mixed-species feeding flocks.



Photo 110. Campo Troupial (*Icterus jamacaii*) is a species of bird that is found in northeastern Brazil. Their diet consists of insects and other small invertebrates, fruits,

and nectar.

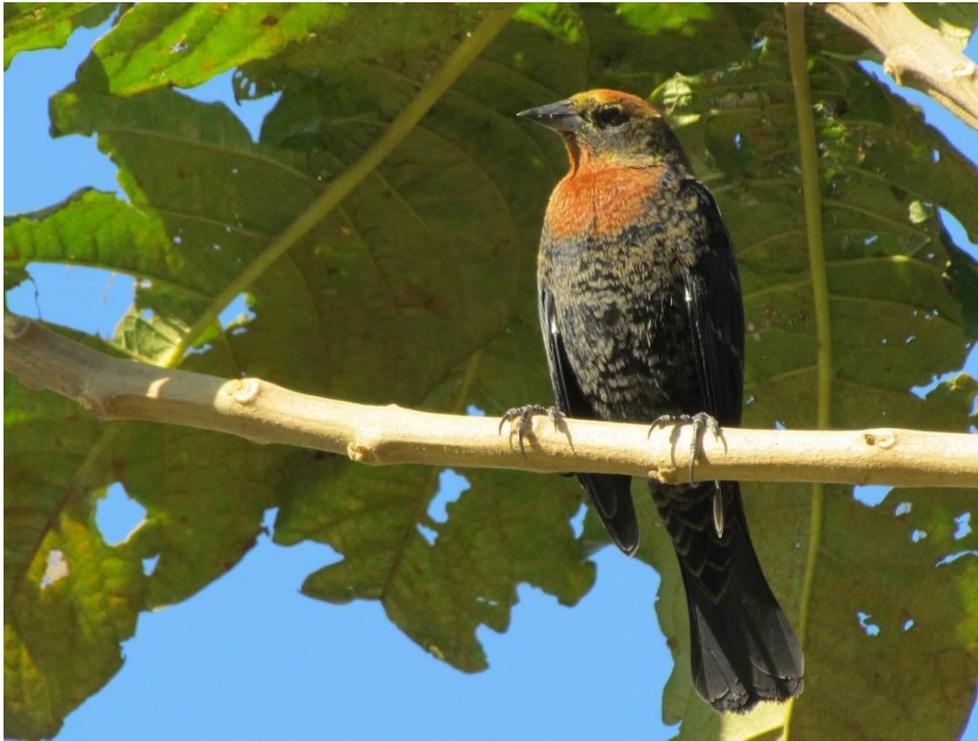


Photo 111. Chestnut-capped Blackbird (*Chrysomus ruficapillus*, young ♂) is a medium-sized blackbird found in marshes, wet grasslands, and occasionally agricultural areas.



Photo 112. White-browed Meadowlark (*Sturnella superciliaris*, ♂) is a medium-sized blackbird found in wet grasslands and agricultural areas.



Photo 113. Red-cowled Cardinal (*Paroaria dominicana*). It occurs in a wide range of dry to semi-humid open to semi-open habitats in north-eastern Brazil, especially the Caatinga region. Unfortunately, is very common to see this species of a bird trapped in a cage.



Photo 114. Hooded Tanager (*Nemosia pileata*, ♀) is a bird that belongs to the family Thraupidae.



Photo 115. Black-throated Saltator (*Saltator atricollis*) is a bird that belongs to the family Thraupidae.



Photo 116. Ultramarine Grosbeak (*Cyanoloxia brissonii*). Bird of exuberant coloration and owner of a beautiful song. Feeds on seeds, fruits, and insects.