

**Rapid Assessment Program**  
Programa de Evaluación Rápida

## **A Rapid Biological Assessment of Ciudad del Jaguar, Ciudad Blanca, La Mosquitia, Honduras**

Evaluación Biológica Rápida en Ciudad  
del Jaguar, Ciudad Blanca, La Mosquitia,  
Honduras

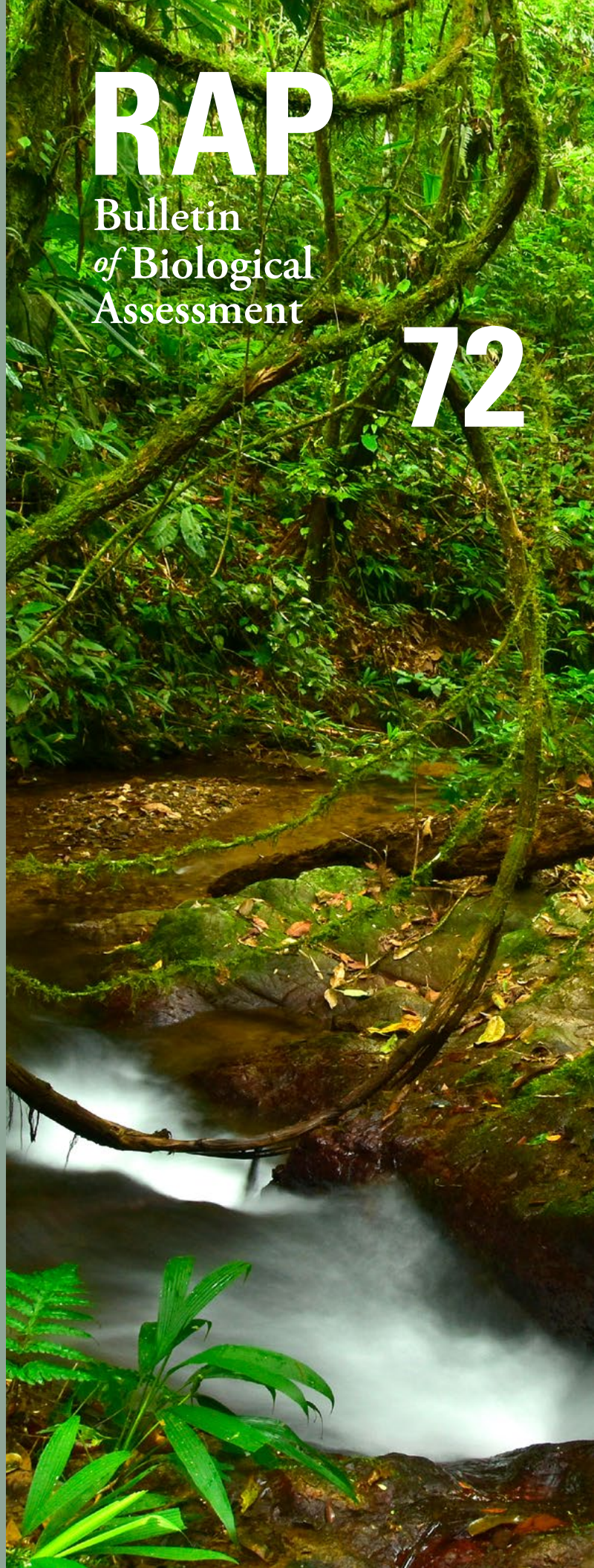
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# RAP

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# Executive Summary

## INTRODUCTION

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The Honduran Mosquitia constitutes one of the least explored and most pristine areas of lowland rain forest remaining in Central America. The Río Plátano Biosphere Reserve (RPBR), located in the Mosquitia region of northeastern Honduras, is the largest protected area in the country. It's 350,000 hectares cover a vast expanse of largely intact ecosystems that include the vital Río Plátano and Río Patuca watersheds. With its more than 28 terrestrial and 5 coastal and marine ecosystem types, it supports the highest biodiversity in Honduras (UNESCO 2001; ICF 2013; Martínez 2014). However, much of the RPBR and the Honduran Mosquitia remain unexplored and poorly known scientifically.

In 2012, a remarkable archaeological discovery was made deep within the heart of this region. A small team of film producers, explorers and scientists, using a new technology (airborne LIDAR), uncovered the ruins of large urban settlements believed to represent the fabled Ciudad Blanca, or White City (also known as Kaha Kamasa in the local Miskito or Pech language). Ongoing research is revealing the incredible mysteries of a civilization that inhabited the area centuries or more ago.

One of the sites currently under investigation has recently been given the name Ciudad del Jaguar (City of the Jaguar). To complement the wealth of cultural knowledge being collected, this expedition was launched in 2017 to conduct a rapid assessment of the biological diversity surrounding Ciudad del Jaguar within the Ciudad Blanca complex. Due to the remoteness of the study area, the team was transported to and from the site via helicopters.

## STUDY AREA

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This biological survey was conducted from February 14-25, 2017 around the Ciudad del Jaguar base camp at an elevation of about 220 masl. Surveys were conducted along existing (but recently created) and new trails, in about 2-3 km in various directions from the base camp (Fig. 1). Ciudad del Jaguar lies within the valley referred to by archaeologists working in the area as T1 (with its center at 15°15'51"N, 84°56'57"W), which itself forms part of the broader complex of Ciudad Blanca.

In general terms, the forest at Ciudad del Jaguar can be broadly classified as Tropical Humid Forest, and more specifically as Lowland Tropical Evergreen Forest with moderate to well-drained soils (Fig. 2; Mejía 2002). Average annual precipitation ranges from 2122 to 2611 mm with the rainiest months from October to December (IHCIT 2012). Average annual temperature varies from 24.9 to 25.6° C with the warmest temperatures from December to February.

Trees 25 to 35 m tall form a closed canopy forest in most areas, with some giant emergent trees exceeding 50 m in height. Typical tree species of the area include *Andira inermis*, *Astronium graveolens*, *Castilla elastica*, *Cedrela odorata*, *Cordia alliodora*, *Luehea seemannii*, *Roystonea* spp.,



*Terminalia oblonga*, *Vochysia ferruginea* and *Vochysia hondurensis*. The primary forest interior consists of an open understory due to the well-developed canopy. Lianas and epiphytes are abundant. Soils of the area are predominantly acidic loam, with a mix of sand and clay, as well as reddish yellow clay, formed above schist and gneiss, with some mixed marble and quartzite, according to Simmons (1968; Fig. 3).

An unusual geographic feature of the study area is that it lies within a relatively flat basin surrounded on all sides and across the broader landscape by steep ridges (Fig. 1). These low but steep hills (about 500 masl) may have sheltered the forests of Ciudad del Jaguar from periodic hurricanes. Numerous small feeder streams flow from the surrounding ridges into two small rivers, which have not yet been formally named, which converge in this basin and exit through a steep, rugged gorge at the valley bottom (Fig. 1). Further downstream and outside of our study area, these rivers join the Pao River, one of the tributaries of the Wampú River which is part of the broader Patuca River watershed.

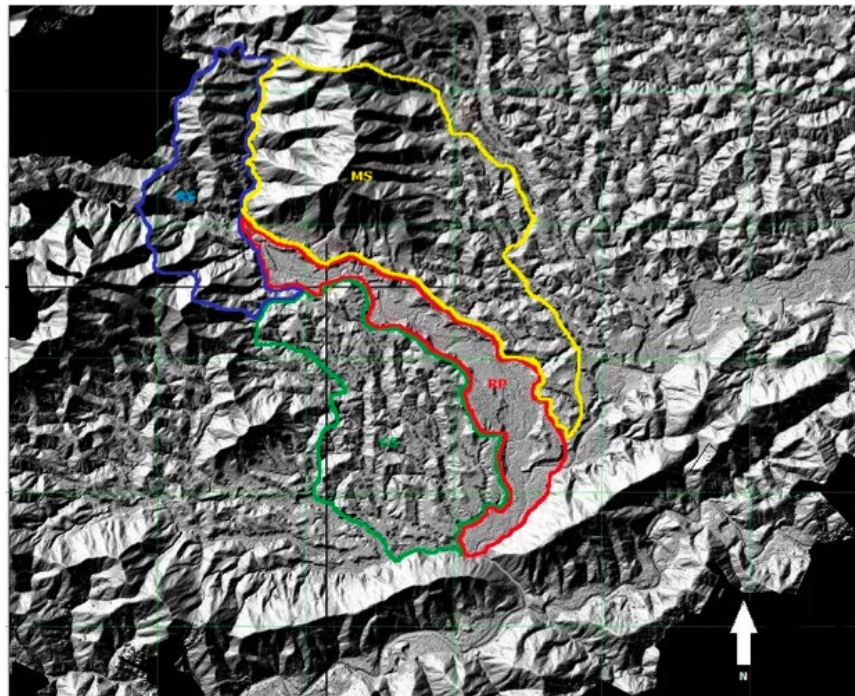
The base camp is located in the southwestern section of the basin, in an upper portion of the valley next to a clearwater river which is relatively oligotrophic. Moving upstream, the terrain becomes steeper, creating fast-flowing cascades and pools around large

boulders (Fig. 1). The water reached a depth of 2.2 m during the dry season at the time of our visit and includes stagnant backwaters and pools in oxbows, shallow riffles, undercut banks, and cascades.

About 2 km downstream from the base camp and towards the southern edge of the valley is the confluence with another small river that is more turbid and sluggish. Flatter areas near the riverbanks are characterized by successional vegetation of varying age. A long and unusually shaped flat terrace (possibly representing an archeological feature) is covered with dense second growth vegetation including *Cecropia* trees, bamboo and some *Musa* spp. (the origin of these banana varieties in the valley is unknown).

## MAJOR RESULTS

The biodiversity of Ciudad Blanca is exceptional in the context of Central America (Table 1). Species richness of most taxonomic groups was higher than has been observed with comparable sampling effort at other sites in Honduras and across the region more broadly. This is due, in part, to the large expanse of diverse and intact ecosystems of which Ciudad Blanca forms a part. Almost all taxonomic



**Figure 1.** Areas surveyed around Ciudad del Jaguar. Blue represents an area with steep ridges and many small streams; yellow represents a drier mountain and ridgeline (~500 masl); green represents a somewhat flatter area near the base camp; red represents the floodplain along the main river as it flows south towards a gorge at the base of the valley.

groups were represented by numerous species that are considered indicators of intact, healthy forest. Many of these species are uncommon or rare in other parts of their range due to habitat loss, degradation, hunting and other pressures. One notable example is the surprisingly high abundance of white-lipped peccaries at the study site, a species that is vulnerable to hunting and requires vast areas of healthy forest to survive. White-lipped peccaries also represent important prey for apex predators such as jaguars which also appear to thrive at the site.

Another factor influencing the unique species richness and composition of Ciudad Blanca is that several species reach their northern distributional range limits in the study area, including Amazonian species. This combination of species with different biogeographic affinities can drive ecological and evolutionary processes that further elevate the site's conservation importance. Our research documented several range extensions, including 22 new species records for Honduras. The site supports at least 43 species of conservation concern, including two Critically Endangered plants (the palm *Reinhardtia gracilis* and the fern *Adiantum pulverulentum*), the Endangered Great Green Macaw and abundant populations of the Endangered Geoffroy's Spider Monkey and Baird's Tapir.

Three remarkable species rediscoveries were made at the study site. These include the Pale-faced Bat *Phylloderma stenops* which had not been reported for Honduras for more than 75 years, the False Tree Coral Snake *Rhinobothryum bonallii* which had not been reported for Honduras since 1965, and the tiger beetle *Odontochila nicaraguense* which had

Table 1. Summary of major results

	Total Species	New species records for Honduras	Threatened species	Species new to science
Plants	183	3	14	
Orchids	19			
Butterflies and moths	246	15		
Other arthropods		3	1	
Fishes	13			1
Amphibians	22		4	
Reptiles	35		8	
Birds	198		9	
Rodents	10			
Bats	30	1	1	
Large mammals	30		6	
<b>Total</b>	<b>779</b>	<b>22</b>	<b>43</b>	<b>1</b>

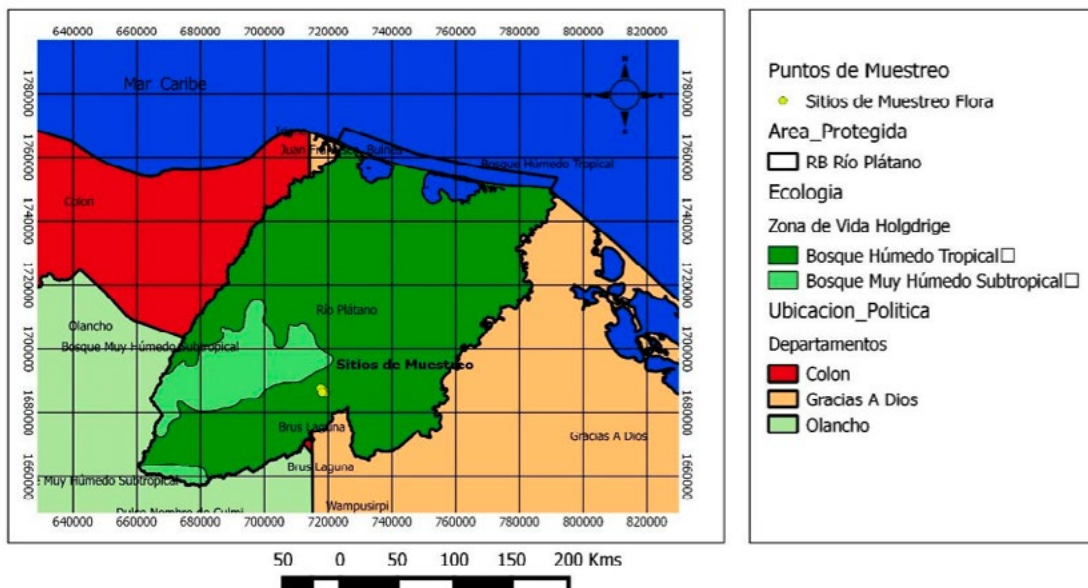


Figure 2. Holdridge life zones in the study region (map by S. Audato Paz)

only ever been recorded in Nicaragua and was believed to be extinct throughout its range. We documented at least one species, a livebearing poeciliid fish called a molly (*Poecilia* sp.), which appears to be new to science. 58 species of plants from the survey have important uses by people, and we observed species typically associated with pre-Hispanic settlements of Mesoamerica, such as cacao (*Theobroma cacao*) and cacao de monte (*Herrania purpurea*).

## RESULTS BY TAXONOMIC GROUP

### Plants

Specimens were collected from flowering and fruiting plants along existing trails and riverbanks. A total of 183 species were identified, belonging to 68 families. We documented 14 threatened species listed in CITES Appendix II as well as ten species from the IUCN Red List. Two species from the study area (the palm *Reinhardtia gracilis* and the fern *Adiantum pulverulentum*) are categorized as Critically Endangered. We found six species considered rare for the zone and 20 species with a restricted range within Mesoamerica. Four species are recognized as indicators of primary forest and seven species of disturbed areas. We documented three new country records for Honduras: *Marcgravia nervosa* (Marcgraviaceae), *Serpocaulon maritimum* (Polypodiaceae) and *Ardisia wedelii* (Primulaceae). 58 species of plants from the survey have important uses by people, which include food, medicine, ornamental uses, timber and

raw material for the production of textiles. We observed species typically associated with pre-Hispanic settlements of Mesoamerica, such as cacao (*Theobroma cacao*) and cacao de monte (*Herrania purpurea*).

### Orchids

Nineteen orchid species were documented during a rapid survey of the Ciudad Blanca area in La Mosquitia, Honduras. Most of the orchid species are canopy specialists and only two recently fallen trees provided a glimpse into the canopy flora. Similar forest in the region can be expected to harbor about 120 orchid species and many more are almost certain to be found at Ciudad Blanca with more exhaustive survey methods. Species observed are indicative of extensive, healthy forest and an absence of people collecting orchids in the area.

### Lepidoptera and other arthropods

246 Lepidoptera (butterfly and moth) species (86 diurnal species and 160 large nocturnal species) were documented. Observations of all insect taxa suggest that diversity and abundance are likely to be exceptionally high around Ciudad Blanca, especially if sampled during the seasonal peak in activity. Fifteen of the Lepidoptera species collected represent new country records, and many of these are large showy species not easily overlooked, including *Morpho menelaus amathonte*, *Caerois gerdrudtus*, and *Prepona dexamenus*. A large tarantula species, *Sericopelma melanotarsum*, was observed

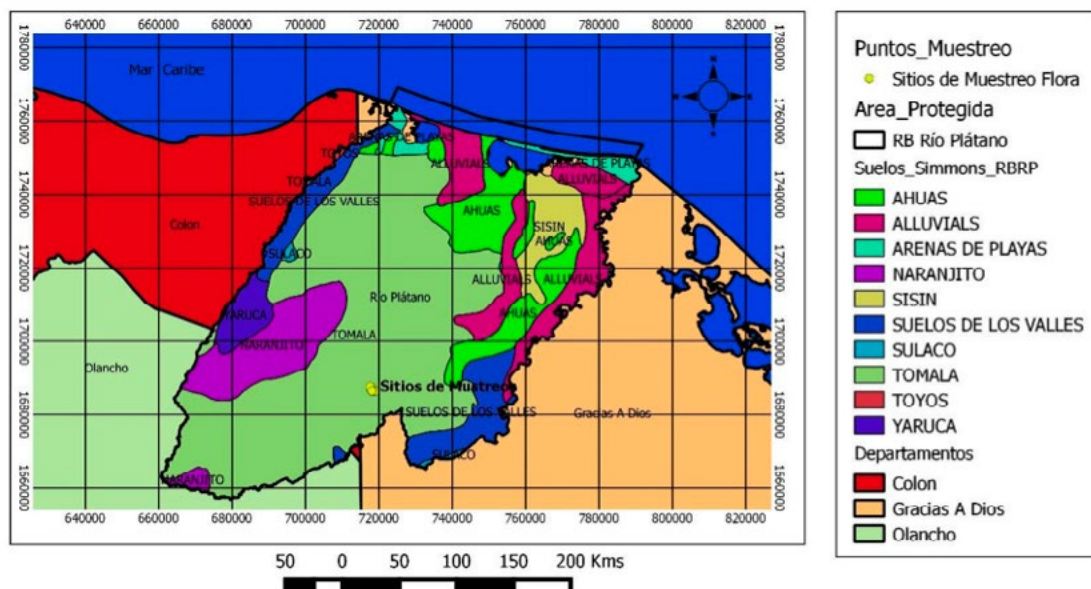


Figure 3. Soil map for the study region (Simmons 1968; map by S. Audato Paz)

around the camp – this genus has not previously been documented north of Nicaragua. The tiger beetle *Odontochila nicaraguense* was rediscovered after being thought extinct and had not previously been recorded in Honduras. The longhorn beetle *Ischnocnemis caerulea* was documented for the first time in Honduras. The findings from this rapid assessment suggest the area harbors a much larger reservoir of undocumented species not present in other parts of Honduras and with apparent affinities to Amazonian communities. Notably, virtually all are species confined to undisturbed Atlantic rain forest, emphasizing the importance of conserving the intact ecosystems around Ciudad Blanca.

### Fishes

A total of 13 fish species was observed, representing the full spectrum of native species expected and lacking invasive introduced species such as *Plecostomus* and *Tilapia* that are found in many Honduran watersheds. Some additional species may be present in the rainy season when they undertake seasonal migrations to headwaters when these are swollen by rain. One unfamiliar poeciliid species may be new to science, supported by recent genetic investigations which indicate that several species in the region likely represent undescribed taxa. Overall, the clear water and species spectrum found indicate that Ciudad Blanca is part of a pristine watershed.

### Amphibians and reptiles

A total of 57 species, 22 of amphibians and 35 of reptiles, were observed, represented by 306 individuals. This diversity is very high considering the brief sampling period. The False Tree Coral Snake *Rhinobothrium bonallii* was rediscovered for Honduras, a species that had not been registered for the country or for northern Central America since 1965 and was only known before an individual in El Paraíso. We documented a new elevational record for the glass frog *Teratohyla spinosa* in the country at 290 masl. Eight of the species found were documented for the time in the core of Reserva del Hombre y la Biosfera del Río Plátano. Several of the observed species are rare and poorly documented for Honduras. The records of *T. spinosa*, *R. bonallii* and the snake *Enuliophis sclateri* establish Ciudad del Jaguar as the northernmost range limit for these species globally. According to the IUCN, we found one Endangered species (the frog *Craugastor lauraster*) and two Near Threatened species (the turtles *Rhinoclemmys annulata* and *Rhinoclemmys funerea*). Other species found, such as the salamander *Oedipina quadra* and the coral snake *Micrurus alleni*, represent priorities for conservation due to their high vulnerability. We registered species that are indicators of pristine ecosystems such as glass frogs and the species *C. lauraster*, *R. bonallii* and *M. alleni*. The results of this study emphasize the high conservation value of the area and

underscore the need for protection against threats such as encroaching agriculture and livestock.

### Birds

198 bird species were observed around T1. We detected 28 species not found by a 2004 survey and literature review for the entire Honduran Mosquitia. Six bird species from the site are listed by the IUCN Red List as Near-Threatened, two as Vulnerable, and one as Endangered – the Great Green Macaw. Fewer than 2,500 mature Great Green Macaw individuals are thought to be surviving in the wild. We documented a 200-km eastward range extension for Rufous-breasted Spinetail (*Synallaxis erythroborax*), a bird found from central Veracruz (Mexico) to Honduras. The study documented only the third record of Tiny Hawk (*Accipiter superciliosus*) for Honduras. Several species of game birds, such as curassows, guans and tinamous, while scarce in most of their Honduran range due to hunting pressure, are relatively common and easily observed at the study site. We found 15 indicator species of intact lowland evergreen forest as well as 17 indicator species of disturbed habitats.

### Small mammals

Forty small mammal species were identified, representing 30 bat species and ten rodent species. 14 of these (35%) are considered species of conservation importance according to the following criteria: 1) conservation status, 2) indicators of habitat quality (e.g., intact forest), or 3) new species records for the department of Gracias a Dios or the country. Of the bats, *Chiroderma trinitatum* is reported as a new record for Honduras and *Hylonycteris underwoodi*, considered a threatened species, is confirmed for Honduras where its prior occurrence had been uncertain. We documented *Phyllostoma stenops*, *Tonatia saurophila* and *Thyroptera tricolor* which are bat species with very restricted distributions and few previous reports for the country. In this study we rediscovered the bat *Phyllostoma stenops* after more than 75 years without any reports for Honduras. We documented 27% of the 110 bat species reported for the country. The new record (*C. trinitatum*) increases the species richness of bats to 111 for Honduras. Three of the rodent species reported in the study area have their northern distribution limit in the Honduran Mosquitia: *Proechimys semispinosus*, *Transandinomys bolivaris* and *Melanomys caliginosus*. Due to high species richness and the presence of rare and/or important small mammal species, the Ciudad Blanca area represents a top conservation priority.

### Large mammals

Due to susceptibility to poaching and often large area requirements, an intact community of native large mammals is one of the best indicators of the conservation status of a site. We recorded a total of 30 medium and large-sized mammalian species which included the entire



expected original fauna of a pristine Mesoamerican humid lowland forest. The study area was found to be a refuge for species that are extremely vulnerable to over-hunting and at the same time important prey for top carnivores. Most notable are the white-lipped peccaries, a species currently found in only 13% of its historic range in Mesoamerica. The presence and frequency of reproductive white-lipped peccary herds at this site is very significant for Honduras and Mesoamerica, immediately elevating the conservation importance of the site and the urgency for its protection. The abundance of preferred game species such as brocket deer, white-tailed deer, Baird's tapir, paca and both peccary species is an indication that hunting levels are extremely low. This complete assemblage of native herbivores has the potential to support the top carnivores without competition from man. The complete community of carnivores including mustelids, procyonids and all five of the cat species occurring in the region (jaguar, puma, ocelot, margay and jaguarundi), observations of all three expected primate species, as well as arboreal kinkajou and cacomistle, and the presence of water opossum and Neotropical river otters provide additional evidence of the well-preserved character of the site from riverside to canopy.

## CONSERVATION RECOMMENDATIONS

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The results of our rapid biological survey show that the Ciudad del Jaguar area supports tremendously rich biodiversity, including many rare and threatened species. It is one of the few areas remaining in Central America where ecological and evolutionary processes remain intact. Among other things, two reasons for this exceptional diversity are that 1) the terrestrial and freshwater ecosystems of the Ciudad del Jaguar area remain largely pristine and 2) the site lies within a much broader expanse of intact forest across the Mosquitia region which includes the Río Plátano Biosphere Reserve, Tawahka Asangni Biosphere Reserve, Patuca National Park and Bosawás Biosphere Reserve. This complex of protected areas represents the largest contiguous forested area in Latin America north of the Amazon.

Nonetheless, there is no time for complacency. Illegal cattle ranching and agriculture are rapidly encroaching and illegal loggers and hunters are increasingly able to access the area. 90% of forest degradation in the Mosquitia region is caused by illegal cattle ranching, which itself is largely driven by drug trafficking. Consequently, conservation strategies ideally should focus at two spatial scales. Direct conservation of the Ciudad del Jaguar area and the T1 valley will continue to benefit from the Honduran military who currently guard and patrol the site. Expanding these patrols beyond the immediate vicinity of the base camp could further boost its protection by deterring illegal activity. Training personnel engaged in patrols to

simultaneously monitor key components of biodiversity could also generate valuable scientific information. Recent and active deforestation could be monitored via aerial surveys and satellite imagery, with enforcement targeting areas prone to illegal activity. While it would require careful evaluation before it could be implemented, it is possible that well-regulated ecotourism could provide another conservation strategy that would help to fund its protection.

The communities of plants and animals at Ciudad del Jaguar remain tightly linked with processes occurring across the broader landscape. Several key species documented during the survey, such as white-lipped peccary and jaguar, move across long distances and require extensive wilderness. For this reason, it is essential that a consortium of international partners continue to work towards protection of the entire Mosquitia region and beyond (e.g., as part of the Mesoamerican Biological Corridor, Jaguar Corridor Initiative and similar efforts to boost ecological connectivity between North and South America). Maintaining this large-scale connectivity across the landscape, with Ciudad Blanca at its core, is essential to achieve long-term success.

The Government of Honduras is firmly committed to protection of the Ciudad Blanca area, even though efforts are sometimes hampered by limited resources. For that reason, in July 2018, at the initiative of President Juan Orlando Hernández, a proposal was launched to establish the Kaha Kamasa Foundation, with two principle goals: to promote ongoing scientific research and to increase monitoring and protection of the rainforest surrounding the archaeological sites at Ciudad Blanca. Kaha Kamasa is a word of Pech roots that means Ciudad Blanca or White City. Four government institutions - the Presidency of the Republic, the Honduran Institute of Science, Technology and Innovation (IHCIETI), the Honduran Institute of Anthropology and History (IHAH) and the Honduran Institute of Forest Conservation (ICF) have joined with the support of several international organizations such as Wildlife Conservation Society and Global Wildlife Conservation, along with journalist and author Douglas Preston, producer Bill Benenson and explorer Steve Elkins, to achieve this mission. By generating knowledge through the study of the mysterious culture that centuries ago had its cradle in this place and improved understanding of its surrounding biodiversity, the Kaha Kamasa Foundation hopes to have the support of the world to preserve the future of this rich heritage of humanity and ensure a green legacy that will enrich the lives of everyone around the planet.

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