

Rediscovery of the Honduran Emerald *Amazilia luciae* in western Honduras: insights on the distribution, ecology, and conservation of a ‘Critically Endangered’ hummingbird

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Summary

The Honduran Emerald *Amazilia luciae* is endemic to dry forests of Honduras and currently recognised as ‘Critically Endangered.’ Here we present the first modern assessment of its distribution, ecology, and conservation, based partly on our rediscovery of the species in western Honduras and on our observations in three Honduran departments. We found that dry forests inhabited by the emerald differed in structure and species composition between eastern and western Honduras, where we observed emeralds in open-canopied deciduous thorn forests and closed-canopied semi-deciduous woodlands, respectively. We interpret these differences in light of the geological and anthropogenic origins of dry forests in Honduras, and discuss the implications of such origins for the conservation of dry forests. Although our findings expand the known distribution and population size of the species, its status as ‘Critically Endangered’ is warranted due to its restricted distribution in dry forest fragments and increasing human pressures on this habitat.

Resumen

El Esmeralda Hondureño *Amazilia luciae* es una especie endémica del bosque seco en Honduras que actualmente es considerada Criticamente Amenazada. Presentamos la primera evaluación moderna de su distribución, ecología, y estado de conservación, con base en nuestro reciente redescubrimiento de la especie en el oeste de Honduras y en nuestras observaciones en tres departamentos hondureños. Describimos que *A. luciae* habita bosques distintos en el este y oeste de Honduras, con los bosques del este siendo espinosos de baja estatura y un dosel abierto, mientras en el oeste son más húmedos, altos, y con su dosel relativamente más cerrado. Damos una interpretación a esas diferencias con base en el origen geológico y las actividades antropogénicas, y discutimos su importancia en la conservación del bosque seco. Aunque el redescubrimiento de *A. luciae* en el oeste de Honduras significa que la distribución y tamaño poblacional de la especie son más amplios que lo antes conocido, su estatus de amenaza como ‘Criticamente Amenazada’ es merecido porque la extensión del bosque seco en Honduras es compuesto por fragmentos aislados que sufren bastante presión de actividades humanas.

Introduction

The Honduran Emerald *Amazilia luciae* is endemic to lowland dry forests in Honduras and is considered ‘Critically Endangered’ because of its restricted range and human pressures on its dry

forest habitat (BirdLife International 2000), yet little is known of its actual distribution, ecology or habitat requirements. The species was originally described in 1867 by George Lawrence from a single specimen lacking any locality or habitat data other than 'Honduras' (Lawrence 1867). Ten more specimens were collected from 1933 to 1950 at six localities in four Honduran departments of the Caribbean slope: Yoro and Olancho in north-central and eastern Honduras, and Cortés and Santa Bárbara in the west (Figure 1; Monroe 1968). The scant data on the original specimen labels constituted all that was known of the species. Despite extensive fieldwork in Honduras, Monroe never observed the species (Monroe 1968), and nothing else was known of its distribution or habitat usage until it was rediscovered in Yoro in 1988 (Howell and Webb 1989) and in Olancho in 1996 (Anderson *et al.* 1998). These brief reports focused mainly on the rediscovery of the species and provided only general characteristics of the habitat and the use of some nectar resources. A more complete knowledge of the Honduran Emerald's geographic distribution and ecological requirements, as well as human impacts on its habitat, are lacking and are required to develop plans to protect and manage the species.

The principal objective of our work is to provide a more thorough description of the distribution, habitats and ecology of the species. This information is based on two foundations: (1) our rediscovery of the species in western Honduras, where it was last observed in 1935, a finding that alters the historic perception of the habitat usage by the species, as well as its known

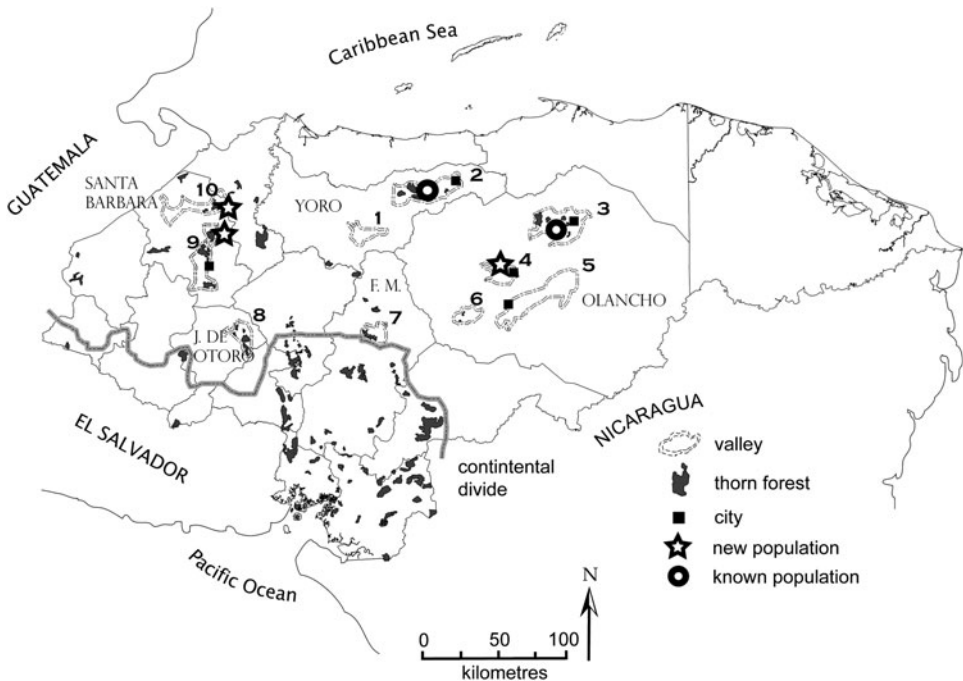


Figure 1. Known current extent of thorn forests in Honduras (dark polygons), and of arid interior valleys named in the text. Previously known and newly discovered populations of the Honduran Emerald *Amazilia luciae* are indicated. Honduran Departments mentioned in the text are named in capital letters (F.M., Francisco Morazán; J. de OTORO, Jesus de Otoro). Valleys identified by numbers (cities): 1: Yoro; 2: Aguán (Olanchito); 3: Agalta (San Esteban); 4: Telica (San Francisco de la Paz); 5: Olancho (Juticalpa); 6: Lepaguare; 7: Talanga; 8: Otoro; 9: Tencoa (Santa Bárbara); 10: Quimistán. The continental divide that separates the Pacific and Caribbean slope drainages is also shown.

distribution; (2) our combined experience of over 20 years working with dry forests in Honduras and with the Honduran Emerald. We further reflect on the conservation status of the species, and offer suggestions for future studies to benefit its conservation.

Methods

Study area

We conducted surveys for the Honduran Emerald within and around arid, intermontane valleys in the Honduran departments of Yoro, Olancho, Santa Bárbara, and Cortés during February 2007 and November 2008. Our surveys were focused at two levels: (1) valleys where the species was known to occur or had been historically reported (Monroe 1968); and (2) nearby valleys with similar climate and habitats where we predicted the species was likely to occur. We therefore focused our searches on these valleys: Agalta, Gualaco, and Telica valleys in Olancho Department; Aguán Valley in Yoro Department; the Tencoa Valley in Santa Bárbara Department; and Quimistán Valley in Santa Bárbara and Cortés Departments (Figure 1).

Habitat searches

We began by using low-level overflights to conduct aerial searches for potentially suitable habitat that would be accessible for subsequent ground searches for hummingbirds. We used overflights to facilitate habitat searches because Honduras has a rugged, mountainous topography, much of which is roadless. Further, within the landscape potentially inhabited by the Honduran Emerald, much of the remaining forest cover is on large, privately owned cattle ranches with restricted access. We conducted overflights in a Cessna 206 fixed-wing aircraft and used global positioning system units (GPS) to mark the centres of forest remnants we observed from the air. On 15 and 16 February 2007 we conducted six hours of overflights along a trajectory that covered approximately 560 km.

Bird surveys

Subsequent to overflights, we visited forest remnants viewed from the air and conducted ground searches for the Honduran Emerald. While searching we walked through potential habitat surveying for hummingbirds from 06h00 to 14h00, during which we used visual and auditory cues to detect and identify hummingbirds. Searching was focused in particular around flowering plants that might be nectar resources for hummingbirds.

We conducted ground searches for Honduran Emerald across a range of elevations (160–750 m) and habitats, including: mixed pine-oak forests, gallery forests along streams, mature dry forests (“thorn forests”), open-canopied *Acacia* spp. scrub, mature moist forests, and forests with different aspects or topography adjacent to forests in which we found the Honduran Emerald. We did so because we suspected that habitat use by the species was incompletely known, and we wanted to increase our chances of finding the species by searching for it in varying forest types. We also reasoned that unsuccessful searches in a variety of habitats within the species’ range would be informative on its habitat preferences.

Ecological observations

Each time we encountered a Honduran Emerald individual we observed the bird for as long as it was in view and noted the species of flowers upon which it foraged. We also recorded broad scale habitat characteristics including dominant overstorey and understorey vegetation, canopy height, and canopy closure.

Additional observations

The authors have a combined experience in excess of 20 years of working with the Honduran Emerald and dry forests in Honduras. Additional anecdotal observations on behaviour and habitat characteristics are derived from this experience.

Results

Distribution

We collected 19 visual observations of the Honduran Emerald in three Honduran departments (Table 1). We rediscovered the Honduran Emerald in western Honduras in two separate valleys in Santa Bárbara Department: the Quimistán Valley (Río Chamelecón watershed) and Tencoa Valley (Río Ulúa watershed; Figure 1). In the Tencoa Valley we found individuals in five fragments separated from each other by at least 5 km, and which measured from five to 60 ha in size. Based on plumage differences and timing and direction of movements we were able to identify a minimum of 10 individuals in the Tencoa Valley. We found a single individual in adult male plumage in the Quimistán Valley in a forest remnant that measured approximately 40 ha. The six forest remnants where we observed Honduran Emerald in Santa Bárbara occurred at elevations from 250 to 345 m. Our observations in Santa Bárbara spanned a 33-km north-south longitudinal transect. These observations represent the first report of Honduran Emerald in western Honduras since 1935. We discovered a population in the Telica Valley, Olancho Department, where the species had not previously been reported. Finally, we also observed the Honduran Emerald in the Agalta Valley (Olancho Department) and the Aguán Valley (Yoro Department) where it was previously known to occur.

Habitat

All our records were from forest fragments ranging in size from five to 100 ha, and at elevations of 250–500 m. Habitats occupied by the Honduran Emerald differed in forest structure and floristic composition between eastern and western Honduras. The habitat in eastern Honduras is an open-canopied xeric woodland or thorn forest characterized by a high incidence of deciduous or semi-deciduous trees and arborescent cacti in the overstorey (*Pilosocereus leucocephalus*, *Acacia deami*, *Chloroleucon mangense*, *Haematoxylon brasiletto*, *Pithecelobium lanceolatum*, *Malpighia glabra*, *Eugenia coyolensis*, *Achatocarpus nigricans*, *Coccoloba acapulcensis*, *Guaiacum sanctum*). Average height of the canopy is 5 m with emergents reaching to 15 m. Similar to the overstorey, thorny species are a dominant characteristic of the understorey, represented by

Table 1. Detections of Honduran Emerald *Amazilia luciae* in five interior valleys of Honduras, February 2007 and November 2008. Numbers represent number of forest fragments surveyed and, in parentheses, the number of fragments in which emeralds were detected.

| Valley | Honduran Department | <i>Acacia</i> scrub | thorn forest | semi-deciduous forest | gallery forest | mature second growth | pine-oak | Elevation range of <i>A. luciae</i> observations (m) |
|-----------|-----------------------|---------------------|--------------|-----------------------|----------------|----------------------|----------|--|
| Aguán | Yoro | | 9 (8) | | | | | 250 |
| Agalta | Olancho | | 10 (3) | | | | | 450–500 |
| Telica | Olancho | | 4 (2) | | | | | 460–500 |
| Tencoa | Santa Bárbara | 2 (0) | 1 (0) | 7 (5) | 5 (0) | 1 (0) | 3 (0) | 200–350 |
| Quimistán | Santa Bárbara, Cortés | | 2 (0) | 2 (1) | 2 (0) | 1 (0) | | 250 |
| Totals | | 2 (0) | 26 (13) | 9 (6) | 7 (0) | 2 (0) | 3 (0) | 48 (19) |

Cactaceae (2 species), Fabaceae (1 species), and Euphorbiaceae (1 species). Epiphytes are abundant on overstorey trees and consist mainly of bromeliads such as *Aechmea bracteata*, *Tillandsia fasciculata*, and the orchids *Myrmecophila wendlandii*, *Laelia rubescens*, and *Encyclia nematocaulon*. Ground cover is sparse. These forests occur almost exclusively on flat slopes of the valley floor at elevations of 200 to 500 m.

Sites occupied by the Honduran Emerald in western Honduras are best described as semi-deciduous woodland, a habitat not previously associated with the species. Canopy height averages 15 m, with a predominance of semi-deciduous broad-leaved tree species, principally *Eugenia oerstediana*, *Bursera simaruba*, and *Tabebuia rosea*, that form a relatively closed canopy. Common understorey species are *Agave parvidentata*, *Tillandsia fasciculata*, *Bromelia pinguin*, *Bromelia plumieri*, and *Acanthocereus pentagonus*. This forest type, rather than occurring on the valley floor, is distributed around the circumference of arid valleys above the valley floor and below the level of lower montane pine-oak forests. Despite searching for the Honduran Emerald in thorn forests on valley floors in western Honduras, we failed to detect it in this habitat type.

Food plants

We observed Honduran Emerald feeding on 14 species of plants, including cacti (Cactaceae: *Melocactus curvispinus*, *Nopalea hondurensis*, *Pilosocereus leucuocephalus*, *Stenocereus yunckeri*), thorny shrubs or low trees (Fabaceae: *Caesalpinia yucatanensis*, *Leucaena lempirana*), vines (Combretaceae: *Combretum fruticosum*), herbs (Acanthaceae: *Aphelandra scabra*, Euphorbiaceae: *Pedilanthus camporum*, Sterculiaceae: *Helicteres guazaumifolia*), epiphytes (Bromeliaceae: *Aechmea bracteata*, *Tillandsia fasciculata*, *Bromelia plumieri*) and parasites (Loranthaceae: *Psittacanthus rhyncanthus*). Use of individual species has not been quantified. However, during field observations in Yoro > 90% of visitation was to *Pedilanthus camporum*, which flowers year-round, and *Nopalea hondurensis*, which flowers principally from February to April. During our brief observations in western Honduras, > 90% of foraging observations were on *Aphelandra scabra* and *Helicteres guazaumifolia*.

Discussion

Based on our observations in western Honduras, the Honduran Emerald is more widespread than recently believed. The population in Santa Bárbara department is 200 km west of the nearest known population in the Aguán Valley. Of greater importance is the discovery that the species is not restricted to thorn forests, and that it inhabits semi-deciduous woodland in the west, a finding that increases the extent of available habitat. Previously, the species was believed to be restricted to arid thorn forests (Schuchmann 1999, BirdLife International 2000), a habitat that has mostly disappeared in western Honduras. Indeed, this belief may have hindered the rediscovery of the species in western Honduras, as searches there were directed at thorn forests (Howell and Webb 1989, Anderson *et al.* 1998), while suitable habitats went overlooked.

Habitat origins and threats

Conservation of Honduran Emerald habitats will depend on an accurate appreciation of the current threats to these habitats, which must in turn be interpreted over both geologic and historical scales. Destruction of dry forests in Honduras for ranching and agriculture has been considered the main threat to the continued existence of the species (Schuchmann 1999, BirdLife International 2000, Thorn *et al.* 2000). Based partly on our observations in a broader habitat type, we argue that this conclusion must be reinterpreted with respect to the origins of, and human impacts on, dry forests in Honduras. Dry forests on the Caribbean slope of Honduras

represent a fragmented, relictual distribution of a once more widely distributed habitat type that originated with Pleistocene aridity 14,000 to 10,000 BP (Duellman 1966, Savage 1966, Leyden 1984, Bush and Colinvaux 1990, Bush *et al.* 1992). The distribution of dry forests has likely experienced several expansions and contractions due to pre-Columbian and post-colonial human activities, including widespread use of fire by native peoples (Stone 1957, Johannessen 1963), followed by the decimation of native peoples during the colonial era, and subsequent variability in stocking rates of livestock over the past 500 years (Johannessen 1963). We argue, therefore, that dry forests in Honduras appear resilient to human intervention. Cattle ranching *per se* is not responsible for the destruction of thorn forest, as primitive ranching methods that rely on machetes and manual labour to cut and remove shrubs and trees from pastures and savannas do little to control the spread of woody plants (Johannessen 1963, Bonta 2003). In contrast, the modernisation of agriculture, wherein tractor-pulled ploughs and bulldozers are used to convert thorn forest to pastures or crops such as cotton, watermelon, and plantains, results in irreversible loss of thorn forest (Bonta 2003).

Conservation

The Honduran Emerald is considered 'Critically Endangered' (BirdLife International 2000) on the basis that it occurs in fragmented habitats of limited distribution that are under continuous pressure from human activities, namely clearing for agriculture and cattle grazing, road construction, and wood extraction (Thorn *et al.* 2000, Bonta 2003). We propose that the conservation of the species will depend on four factors: conservation of its habitat; studies on its distribution within suitable habitats, estimates of population density and total population size; and genetic analyses to determine if the populations that appear geographically isolated are connected genetically through dispersal.

The Aguán Valley is currently considered to contain the largest extent of thorn forest in Honduras, recently estimated at 8,495 ha (Thorn *et al.* 2000). Of this total, the four largest fragments measured between 360 and 476 ha, for a combined total of 1,704 ha. The rate at which thorn forest was cleared from 1994 to 2000 averaged 379 ha per year (Thorn *et al.* 2000). In comparison, coverage of thorn forest in Olancho is more restricted. We know of only a single forest remnant larger than 100 ha, and based on aerial imagery, our overflights, and ground searches, we conservatively estimate that fewer than 2,000 ha of habitat remains in Olancho.

In 2005 the Honduran government created a reserve for the explicit purpose of protecting the species and its habitat (Lobo Sosa 2005). Located 34 km west of the city Olanchito, the official name of the reserve is 'Área de Manejo Hábitat y Especie Colibrí Esmeralda Hondureño'. The reserve measures 1,217 ha and encompasses elevations from 220 to 800 m. There are 651 ha of dry forest habitat suitable for the Honduran Emerald, all at lower elevations (Thorn *et al.* 2000).

Distribution, population density and population size

The actual distribution of the Honduran Emerald is still incompletely known. Within dry forests, the species has only ever been reported from interior valleys on the Caribbean Slope (Monroe 1968). We recommend that searches be conducted in the following Caribbean slope valleys: the Olancho (= Guayape), Guaimaca, and Lepaguare valleys in Olancho Department; the Locomapa and Yoro valleys in Yoro Department; the Otoro Valley in Intibucá Department; and the Talanga Valley in Francisco Morazán Department (Figure 1). Finally, the Honduran Emerald may even occur in semi-deciduous woodlands in nearby Guatemala. No estimates of population density exist for any sites where the Honduran Emerald is known, and there are no estimates, even grossly approximate ones, for the overall population size of the species. Monitoring of future population trends throughout Honduras will depend on baseline estimates of population densities and sizes at the current time.

Dispersal

At least 18 species in the genus *Amazilia* engage in seasonal and elevational movements or post-breeding dispersal (Schuchmann 1999). These movements presumably arise in response to seasonal availability of nectar resources in arid habitats, such as that inhabited by the Honduran Emerald. It is not known if or how far individuals of Honduran Emerald disperse, what habitats are important for dispersal, or which of the populations are linked genetically through dispersal. Such data are needed if it is eventually determined that populations in discrete arid valleys are linked through dispersal.

Our rediscovery of the Honduran Emerald in western Honduras increases the known distribution and population size of the species, giving additional hope for its conservation. Nonetheless we recommend that its status as 'Critically Endangered' be maintained pending future investigations, because the habitats occupied by the Honduran Emerald are restricted in distribution and continue to be affected by human activities, and because basic components of its life history, including seasonal movements and population densities, are still unknown.

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