The herpetofauna of Parque Nacional Cerro Azul, Honduras (Amphibia, Reptilia)

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ABSTRACT — Seventy-four species of amphibians and reptiles (4 salamanders, 24 anurans, 1 turtle, 15 lizards, and 30 snakes) are recorded from Parque Nacional Cerro Azul, located in the northwestern portion of the Honduran department of Copán. The park has an area of about 155 km^2 of mountainous terrain located in the Premontane Wet Forest and Lower Montane Wet Forest formations. Elevations in the park range from 770 to 2285 m. Lower elevations of the park are subject to the Intermediate Wet climate and the higher elevations to the Highland Wet climate. Population declines or disappearances of 23.0% of the herpetofaunal species are documented in the park. Only 21.6% of the entire Honduran mainland and insular herpetofauna, 36.9% of the species found in the Premontane Wet Forest formation, and 44.0% of the species found in the Lower Montane Wet Forest formation are afforded nominal protection in the park. Careful and continuing monitoring of the park's remaining herpetofaunal populations will be necessary, especially due to the severe habitat degradation resulting from continuing deforestation. *Lepidophyma mayae* is reported from Honduras for the first time.

RESUMEN — En el parque nacional Cerro Azul se han documentado un total de 74 especies de anfibios y reptiles (cuatro salamandras, 24 anuros, una tortuga, 15 largartijas y 30 culebras). Este parque esta ubicado al noroeste del Departamento de Copán y tienen un área de aproximadamente 155 kilometros^2 de terrenos montañosos comprendidos en la formaciones de Bosque Húmedo Premontano y Bosque Húmedo Montano Bajo. Las elevaciones en el parque tienen un rango que va desde 770 hasta 2285 m. Las partes bajas reciben influencia de un clima intermedio húmedo y las partes altas de un clima húmedo de altura. Se han documentado declines poblacionales de las 23.0% de las especies de la herpetofauna del parque. Solo el 21.6% de toda la herpetofauna de Honduras (continental y insular), el 36.9% de las especies encontradas de la formación Bosque Húmedo Premontano y 44.0% de las especies encontradas en la formación Bosque Húmedo Montano Bajo reciben protección nominal en este parque. Es necesario un cuidadoso y continuo monitoreo de la herpetofauna que aun existe en esta reserva, especialmente debido a una severa degradación del hábitat ocasionada por la deforestación. Se reporta *Lepidophyma mayae* por la primera vez en Honduras.

A series of publications was recently begun that have been concerned with the composition, distribution, and conservation status of the amphibians and reptiles occurring in various Honduran biotic reserves (Espinal *et al.*, 2001; Wilson & McCranie, 2004c). It has become increasingly clear that population declines are transpiring among the amphibian and reptile species inhabiting the biotic reserves, even in areas that remain relatively pristine. In this paper, I discuss the herpetofauna of Parque Nacional Cerro Azul, a park that has seen severe habitat destruction since I first visited the area in 1982, five years before it was declared a national park.

MATERIALS AND METHODS

I have made six trips for a total of 42 days collecting in the park (7-10th August 1982, 17th-21st July 1983, 4th–10th May 1988, 15th–21st July 1996, 17th–21st October 1998, and 17th–30st July 2004. The Coefficient of Biogeographic Resemblance algorithm (Duellman, 1990) was used to demonstrate herpetofaunal relationships between the two forest formations herein

considered. The formula is CBR = 2C/(N1 + N2), where C is the number of species in common to both formations, N1 is the number of species in the first formation, and N2 is the number of species in the second formation.

Museum acronyms for the specimens listed in Appendix I follow those of Leviton *et al.* (1985).

Description of the Park

Parque Nacional Cerro Azul is located in the Sierra del Espíritu Santo in the northwestern portion of the Honduran department of Copán. The park encompasses an area of approximately 155 km^2, with a nuclear zone of about 9 km^2 and a buffer zone of about 146 km^2 (Wilson *et al.*, 2001). Elevations in the park range from 770 m at Laguna del Cerro to 2285 m at the highest elevation on Cerro Azul, with the nuclear zone occurring at elevations of 1600 m and above. The village of Quebrada Grande lies at the foot of Cerro Azul approximately between 1250 to 1370 m elevations. There is no visitor's centre in the park.

Physiography

Parque Nacional Cerro Azul is located within the largest physiographic area in Honduras, the *Serranía* (Wilson *et al.*, 2001). Moreover, it is found within the northwestern portion of the *Serranía*, called the Northern Cordillera. The park is situated within the Sierra del Espíritu Santo, which forms a portion of the border between Honduras and Guatemala. The range is bounded on the northeast by the Sierra de Omoa, on the east by the valley of the Río Chamelecón, on the west and north by the valley of the Río Motagua in Guatemala, and on the south by the valley of the Río Morjá (a tributary of the Río Motagua) and its tributaries.

Climate

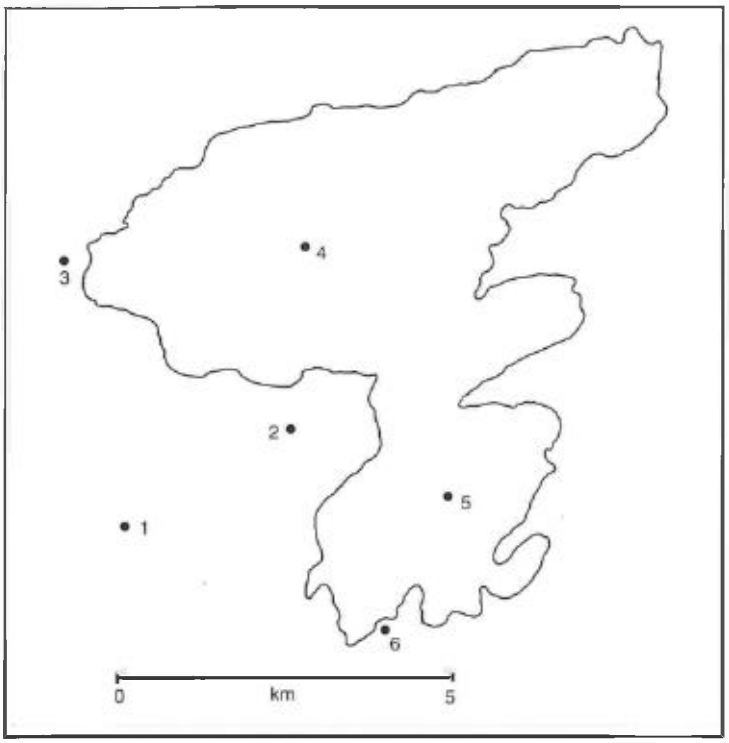
The park is subject to two climatic regimes. The lower elevations of the park are subject to the Intermediate Wet climate and the higher elevations to the Highland Wet climatic regime (Wilson & Meyer, 1985). The Intermediate Wet climate is characterized by an altitudinal range of 600 to 1500 m, a mean annual rainfall of 2000 mm or more, and a mean annual temperature of 18 to 24°C. The Highland Wet climate is characterized by an altitudinal range of 1500 to 2700 m, a mean annual rainfall of 1500 mm or more, and a mean annual temperature of 18°C or less.

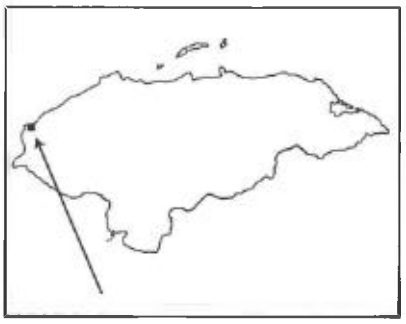
Vegetation

The vegetation of Parque Nacional El Cusuco is referable to the Premontane Wet Forest and Lower Montane Wet Forest formations, as slightly modified from Holdridge (1967). Premontane Wet Forest is found at elevations in the park from 770 to about 1350 m and is characterized by a mean annual precipitation range of 2000 to 4000 mm and a mean annual temperature range of 18° to 24°C. Lower Montane Wet Forest is found at elevations in the park above about 1350 m and is characterized by a mean annual precipitation range of 2000 to 4000 mm and a mean annual temperature range of 12° to 18°C (Wilson & Meyer, 1985).

Anonymous (1993) discussed the makeup of the vegetation of Lower Montane Wet Forest in Parque Nacional Cerro Azul. The undisturbed forest was described as consisting predominantly of broad-leafed trees and, to a lesser extent, conifers (including *Pinus oocarpa* or Ocote and *P. pseudostrobus* or Pinabete). The broad-leafed species include *Alchornea latifolia* (Amate), *Ardisia paschalis* (Uva), *Calophyllum* spp. (María), *Calatola mollis* (Nogal), *Cedrella oaxacensis* (Cedro), *Chamaedora pacaya* (Pacaya), *Gaultheria odorata* (Matapalo), *Liquidambar styraciflua* (Liquidambar), and *Quercus peduncularis* (Roble).

Premontane Wet Forest in the lower reaches of Parque Nacional Cerro Azul was described by Anonymous (1993) as a forest composed, at the upper stratum, of large trees growing to heights of more than 40 m and diameters of more than a meter. These trees are generally buttressed, with smooth trunks, and branches arising at a great height, and include such species as *Pterocarpus hayesii* and *P. officinalis* (both called Sangre blanco) and *Virola guatemalensis* and *V. koschayi* (both called Sangre colorada). Other species in the upper stratum include *Calophyllum brasiliense* (María), *Symphonia globulifera* (Varillo), and





Boundary of nuclear zone of Parque Nacional Cerro Azul (left) and an outline map of Honduras (above) showing the park's location. The park's buffer zone has not been adequately defined to show its limits. Localities are: (1) Laguna del Cerro; (2) Quebrada Grande; (3) San Isidro; (4) highest peak of Montaña del Cerro Azul; (5) Cerro Los Dantos; and (6) San Joaquín.

Vochysia hondurensis (San juan). A middle stratum consisting of shorter trees of the genera *Annona*, *Brosimun*, *Pithecolobium*, *Protium*, *Casearia*, and various laurels is present. The lower stratum is composed of members of the genera *Cupania*, *Psidium*, *Persea*, *Mabea*, *Cordia*, and *Casearia*. The floor of the forest is populated principally by *Swartzia simplex* (Yaya), *Carpotroche platyptera* (Jagua), and *Faramea occidentalis* (Cafecillo).

Microhabitats

Many microhabitats exist in the park. There are several streams and small rivers that provide habitat for streamside anurans of the genera *Duellmanohyla*, *Plectrohyla*, *Ptychohyla*, and *Rana*, and their larvae. A small, fishless lake occurs at 770 m elevation that provides ideal habitat for anurans of the genera *Agalychnis* and *Hyla* and turtles of the genus *Kinosternon*. However, the vegetation around all of these aquatic habitats has been removed almost completely since my first visit to the area in 1982. The epiphytic bromeliads, that were once numerous throughout forested areas, are utilized by several salamander species of the genus *Bolitoglossa* and the bromeliad frog *Hyla bromeliacia*. A few small temporary ponds are located in cleared areas in the vicinity of the village of Quebrada Grande. A small man made pond near San Isidro provides habitat for several species of pond breeding anurans. Numerous rock outcroppings occur on hillsides in the park.

RESULTS

Composition

The known herpetofauna of Parque Nacional Cerro Azul (Table 1) consists of 74 species, including four salamanders (5.4%), 24 anurans (32.4%), 1 turtle (1.4%), 15 lizards (20.3%), and 30 snakes (40.5%).

Broad patterns of geographical distribution

As did Wilson & Meyer (1985), Wilson *et al.* (2001), and McCranie & Wilson (2002), I placed the species occurring in the park into a set of distributional categories based on the entire extent of their geographic range (Table 1). Two of the categories used by Wilson *et al.* (2001) do not apply to this paper (marine species [category K],

and insular and/or coastal species [category L]). The applicable categories are as follows:

A. Northern terminus of the range in the United States (or Canada) and southern terminus in South America;

B. Northern terminus of the range in the United States and southern terminus in Central America south of the Nicaraguan Depression;

C. Northern terminus of the range in the United States and southern terminus in Nuclear Middle America;

D. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and the southern terminus in South America;

E. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in Central America south of the Nicaraguan Depression;

F. Northern terminus of the range in Mexico north of the Isthmus of Tehuantepec and southern terminus in Nuclear Middle America;

G. Northern terminus of the range in Nuclear Middle America and southern terminus in South America;

H. Northern terminus of the range in Nuclear Middle America and southern terminus in Central America south of the Nicaraguan Depression;

I. Restricted to Nuclear Middle America (exclusive of Honduran endemics);

J. Endemic to Honduras.

The data on broad distributional patterns in Table 1 indicate that the largest number of species (22 or 29.7% of a combined total of 74 species) fall into the I category, i.e., that containing the Nuclear Middle American-restricted species (exclusive of the Honduran endemics). The next largest categories are F and E, with 14 (19.2%) and 13 (17.6%) species, respectively. Together, these three categories comprise 66.2% of the total for the park. The other eight categories contain from one to ten species each and harbour, as a group, 33.8% of the total number. Six (8.1%) Honduran endemics occur within the park.

Park distribution

I established three categories of distribution of the members of the herpetofauna within Parque Nacional Cerro Azul (Table 1). Species are considered to be widespread in the park, restricted to the park or its immediate environs (although, in some cases, species may be distributed otherwise outside of Honduras), and peripherally distributed in the park. Fifty-eight species (78.3% of total species) are categorized as widespread (four salamanders, 15 anurans, ten lizards, 29 snakes), seven (9.5%) as restricted (three anurans, four lizards), and nine (12.2%) as peripheral (six anurans, one turtle, one lizard, one snake).

Ecological distribution

Of the 74 species making up the known herpetofauna of Parque Nacional Cerro Azul, 12 (16.2%) are recorded only from Lower Montane Wet Forest, 30 (40.5%) only from Premontane Wet Forest, and 32 (43.2%) from both forest formations. The Coefficient of Biogeographic Resemblance (see Materials and Methods) for these two formations in the park is 0.60.

In terms of vertical positioning within the primary microhabitats in the park, 41 species (55.4%) were usually found only in terrestrial settings, 31 (41.9%) only in arboreal ones, and two (2.7%) in both terrestrial and arboreal situations (Table 1). With respect to occurrence in the three major habitats in the parks (forest proper, streamside, and lakeside or pond-side), 53 species (71.6%) were found only within the forest proper, nine (12.2%) only along streams, nine (12.2%) only around the lake or ponds, two (2.7%) in the forest and along streams, and one (1.4%) in the forest and around ponds (Table 1).

If the two sets of categories, vertical position within the primary microhabitat and the major habitats, are combined, then 19 species (25.7%) are arboreal forest inhabitants, seven (9.5%) are arboreal lakeside or pond-side inhabitants, five (6.8%) are arboreal streamside inhabitants, 32 (43.2%) are terrestrial forest inhabitants, two (2.7%) are terrestrial lakeside or pond-side inhabitants, four (5.4%) are terrestrial streamside inhabitants, two (2.7%) are terrestrial forest and

Species	Park Distribution	Elevational Range (m)	Forest Formation	Broad Distribution Pattern	Primary Microhabitat	Relative Abundance	Conservation Status
Bolitoglossa conanti	W	1250–1600	PWF, LMWF	I	A, F	C	D
Bolitoglossa dofleini	W	1040–1370	PWF, LMWF	I	A, T, F	C	S
Bolitoglossa dunni	W	1370–1600	LMWF	I	A, F	C	D
Bolitoglossa rufescens	W	1000–1370	PWF, LMWF	I	A, F	C	S
Bufo campbelli	P	770–1080	PWF	F	T, F	R	D
Bufo valliceps	W	770–1250	PWF	E	T, F, P	I	S
Hyalinobatrachium fleischmanni	P	770	PWF	D	A, S	R	D
Agalychnis callidryas	P	770	PWF	E	A, P	C	S
Agalychnis moreletii	W	770–1300	PWF	F	A, P	I	D
Duellmanohyla soralia	W	770–1370	PWF, LMWF	I	A, S	C	S
Hyla bromeliacia	W	1250–1600	PWF, LMWF	I	A, F	C	D
Hyla loquax	P	770	PWF	E	A, P	C	S
Hyla microcephala	P	770	PWF	D	A, P	C	S
Hyla picta	P	770	PWF	F	A, P	R	S
Hyla salvaje	R	1370	LMWF	I	A, F	R	D
Plectrohyla guatemalensis	W	1150–1480	PWF, LMWF	I	A, S	I	D
Plectrohyla matudai	W	770–1480	PWF, LMWF	I	T, S	C	S
Ptychohyla hypomykter	W	770–1600	PWF, LMWF	I	A, S	C	S
Scinax staufferi	W	1300	PWF	E	A, P	R	N
Smilisca baudinii	W	770–1370	PWF, LMWF	B	A, P	C	S
Eleutherodactylus charadra	W	770–1370	PWF, LMWF	I	T, F, S	C	S
Eleutherodactylus coffeus	R	900–1200	PWF	J	T, F	C	S
Eleutherodactylus laticeps	W	1040–1300	PWF	F	T, F	I	S
Eleutherodactylus milesi	W	1050–1400	PWF, LMWF	J	T, S	I	E
Eleutherodactylus rostralis	W	980–1370	PWF, LMWF	I	T, F	I	S
Eleutherodactylus sp.	R	900–1200	PWF	J	A, F	C	S
Rana brownorum	W	770–1370	PWF, LMWF	F	T, P	C	S
Rana maculata	W	770–1370	PWF, LMWF	I	T, S	I	D
Kinosternon leucostomum	P	770	PWF	D	T, P	R	S
Abronia montecristoi	R	1370	LMWF	I	T, F	R	N
Laemanctus longipes	W	1120	PWF	F	A, F	R	D
Sceloporus malachiticus	W	1250–1840	PWF, LMWF	H	A, F	C	S
Norops biporcatus	P	770	PWF	D	A, F	R	D
Norops capito	W	770–1040	PWF	H	A, F	I	S
Norops johnmeyeri	W	1370–1480	LMWF	J	A, F	I	S
Norops laeviventris	W	1250–1480	PWF, LMWF	E	A, F	I	S
Norops ocelloscapularis	R	1040–1370	PWF, LMWF	J	A, F	C	S
Norops petersii	R	1370–1400	LMWF	F	A, F	R	N
Norops rodriguezii	W	770–1250	PWF	F	A, F	I	S
Norops uniformis	W	770–1370	PWF, LMWF	F	T, F	C	S
Sphenomorphus cherriei	W	770–1300	PWF	E	T, F	I	S
Ameiva festiva	W	1300	PWF	G	T, F	R	N
Lepidophyma flavimaculatum	W	1040–1300	PWF	E	T, F	I	S
Lepidophyma mayae	R	1040	PWF	I	T, F	R	N
Typhlops stadelmani	W	1250–1370	PWF, LMWF	J	T, F	C	S
Boa constrictor	W	1370	LMWF	D	T, F	R	N
Adelphicos quadrivirgatum	W	1040–1370	PWF, LMWF	F	T, F	C	S
Clelia clelia	P	770	PWF	G	T, F	R	D
Coniophanes bipunctatus	W	1370	LMWF	E	T, S	R	N
Coniophanes fissidens	W	1040	PWF	D	T, F	R	S
Coniophanes imperialis	W	1040	PWF	C	T, F	R	S
Dryadophis dorsalis	W	1370–1600	LMWF	I	T, F	I	D
Dryadophis melanolomus	W	1040	PWF	E	T, F	R	S
Drymobius chloroticus	W	1370–1480	LMWF	F	T, F, S	I	D
Drymobius margaritiferus	W	860–1370	PWF, LMWF	A	T, F	I	S
Geophis fulvoguttatus	W	1680	LMWF	I	T, F	R	N
Imantodes cenchoa	W	1200–1370	PWF, LMWF	D	A, F	C	S
Lampropeltis triangulum	W	1040–1370	PWF, LMWF	A	T, F	C	S
Leptodeira septentrionalis	W	1250–1370	PWF, LMWF	A	A, F	I	S
Ninia diademata	W	1250–1370	PWF, LMWF	F	T, F	C	S
Ninia espinali	W	1040	PWF	I	T, F	I	N

Species	Park Distribution	Elevational Range (m)	Forest Formation	Broad Distribution Pattern	Primary Microhabitat	Relative Abundance	Conservation Status
Ninia sebae	W	1250	PWF	E	T, F	I	S
Pliocercus elapoides	W	1040–1370	PWF, LMWF	F	T, F	I	S
Rhadinaea kinkelini	W	900–1370	PWF, LMWF	I	A, T, F	I	S
Rhadinaea montecristi	W	1370–1600	LMWF	I	T, F	I	D
Sibon dimidiatus	W	1200–1400	PWF, LMWF	E	A, F	C	S
Sibon nebulatus	W	1250	PWF	D	A, F	I	S
Stenorrhina degenhardtii	W	1040–1370	PWF, LMWF	D	T, F	C	S
Tantilla impensa	W	1370–1600	LMWF	I	T, F	I	S
Tantilla schistosa	W	1040–1370	PWF, LMWF	E	T, F	I	S
Micrurus diastema	W	770–1680	PWF, LMWF	F	T, F	C	S
Atropoides mexicanus	W	1250–1300	PWF	E	T, F	C	S
Bothriechis thalassinus	W	1250–1600	PWF, LMWF	I	A, S	I	D
Bothrops asper	W	1300	PWF	D	T, F	R	N

Table 1. Distribution of the 74 species of amphibians and reptiles known from Parque Nacional Cerro Azul. Abbreviations include: Park Distribution-W = widespread in park, R = restricted to park or immediate environs (also includes species distributed outside of Honduras, but known from Honduras only in the park), P = peripherally distributed in park; Forest Formation-PWF = Premontane Wet Forest, LMWF = Lower Montane Wet Forest; Primary Microhabitat-A = arboreal, T = terrestrial, F = forest inhabitant, P = lakeside or pondside inhabitant; S = streamside inhabitant; Relative Abundance-C = common, I = infrequent, R = rare; Conservation Status-S = stable populations in Parque Nacional Cerro Azul, D = all Parque Nacional Cerro Azul populations declining, E = extirpated from park, N = no data on population status. See text for explanation of Broad Distribution Pattern abbreviations.

streamside inhabitants, two (2.7%) are arboreal and terrestrial forest inhabitants, and one (1.4%) is a terrestrial forest and pond-side inhabitant.

Relative abundance

The 74 species known from the park are classified as being common (found on a regular basis, many individuals can be found), infrequent (unpredictable, few individuals seen), and rare (rarely seen). These classifications are in part historical (i.e., based in part on earlier trips to the parks) and do not take into consideration the population declines taking place for several species (see next section). Twenty-eight species (37.8%) are classified as being common (four salamanders, 12 anurans, three lizards, nine snakes), 26 (35.1%) as being infrequent (seven anurans, six lizards, 13 snakes), and 20 (27.0%) as being rare (five anurans, one turtle, six lizards, eight snakes).

Population declines

Population declines, especially of amphibians, are proceeding in this national park, as is the case elsewhere in Honduras (McCranie & Wilson, 2002; Wilson & McCranie, 1998, 2004a). Of the 28 species of amphibians presently known from the park, ten (35.7%) have either all of their park populations apparently declining (9) or are apparently extirpated from the park (1). The latter (*Eleutherodactylus milesi*) is feared extinct. Those with declining populations are *Bolitoglossa conanti*, *B. dunni*, *Bufo campbelli*, *Hyalinobatrachium fleischmanni*, *Agalychnis moreletii*, *Hyla bromeliacia*, *H. salvaje*, *Plectrohyla guatemalensis*, and *Rana maculata*. Some of this decline appears to be part of a general pattern of disappearance of streamside *Eleutherodactylus* populations in the country occurring at about 900 m elevation and higher (McCranie & Wilson, 2002). However, the

Above: *Eleutherodactylus coffeus*. Below: *Micrurus diastema*.
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greatest cause of these declines is habitat destruction (see next section). In addition, all tadpoles of *Plectrohyla matudai* collected from three localities (900–1480 m elevation) in the park in 2004 have deformed mouthparts. However, these populations are considered stable because of the large numbers of adults that could be seen in 2004.

Of the 46 species of reptiles recorded for the park, seven (15.2%) are thought to have all of their park populations declining, including *Laemanctus longipes*, *Norops biporcatus*, *Clelia clelia*, *Dryadophis dorsalis*, *Drymobius chloroticus*, *Rhadinaea montecristi*, and *Bothriechis thalassinus*. The primary reason for these declining populations is habitat destruction (see next section). Nine other reptile species are insufficiently known in the park to determine their conservation status. Also, numerous other species of amphibians and reptiles that have stable populations somewhere in the park have had other populations negatively impacted by the widespread habitat destruction.

Parque Nacional Cerro Azul contains six Honduran endemics, including *Eleutherodactylus coffeus*, *E. milesi*, *Eleutherodactylus* sp., *Norops johnmeyeri*, *N. ocelloscapularis*, and *Typhlops stadelmani*. Three of these Honduran endemics (*Eleutherodactylus coffeus*, *Eleutherodactylus* sp., and *Norops ocelloscapularis*) are not known outside of Parque Nacional Cerro Azul. One, *E. milesi*, is thought to be extinct. Given the above-indicated cases of decline or disappearance, it is critical that the populations of those species be carefully monitored for changes in their population status.

Eleutherodactylus rostralis

Lampropeltis triangulum

Pliocercus elapoides

Bothriechis thalassinus

IMPORTANCE OF THE PARK AS A HERPETOFAUNAL REFUGE

As currently understood, the herpetofauna of the mainland of Honduras, Bay Islands, Cayos Cochinos, Miskito Keys, Swan Islands, and territorial waters consists of 348 species (unpubl. data), including 121 amphibians and 227 reptiles (six of which are marine in distribution). The known herpetofauna of Parque Nacional Cerro Azul (74 species), thus, comprises 21.6% of the 342 species known from the mainland and insular environments in Honduras. The percentage of the various mainland and insular species afforded nominal protection in the park varies widely. Neither of the two species of caecilians nor of the two crocodilians is recorded from the park. The percentages of the other groups are as follows: salamanders (15.4% of 26 species); anurans (25.8% of 93 species); turtles (11.1% of 9 non-marine species); lizards (16.9% of 89 species); and snakes (24.8% of 121 non-marine species).

However, the above figures are misleading, inasmuch at Parque Nacional Cerro Azul harbours only two of the forest formations located in Honduras. Therefore, it is more useful to assess the park's importance by comparing the herpetofaunal composition of the two forest formations in the park with that of the same formations in the country as a whole. McCranie & Wilson (2002) and Wilson & McCranie (2004b) demonstrated the presence of 15 salamander species and 28 anuran species in Lower Montane Wet Forest in Honduras. With the addition of one salamander species to this forest formation (McCranie *et al.*, 2005), the park's four salamander species found in this formation make up 25.0% and its 12 anurans 42.9% of the whole. Wilson & McCranie (2004b) recorded 22 lizards

and 33 snakes from this same forest formation. With the addition of one species of snake to this forest formation (McCranie & Castañeda, 2004), the park's seven lizard species found in this formation constitute 31.8% and its 21 snake species comprise 61.7% of the whole. With respect to Premontane Wet Forest, McCranie & Wilson (2002) listed nine salamander and 59 anuran species. The *Eleutherodactylus* sp. reported herein from Premontane Wet Forest is an addition to that formation; thus, there is a total of 60 anuran species now known from this formation. Therefore, the park's three salamander species found in this formation constitute 33.3% and its 23 anuran species 38.3% of the whole. Reptile species recorded from Premontane Wet Forest include three turtles, 35 lizards, and 61 snakes (unpubl. data). Thus, the park's one turtle species found in this formation comprises 33.3%, its 12 lizard species 34.3%, and its 23 snake species 37.7% of the whole.

During my visits to Parque Nacional Cerro Azul over the years, it has been obvious that the buffer zone has been subjected to increasing degradation, due to the conversion of the land to pastures and croplands, as has been noted in almost every other biotic reserve in Honduras (Wilson *et al.*, 2001; Wilson & McCranie, 2003, 2004a). On my first trip to the area in 1982, the entire region between Laguna del Cerro and the vicinity of Quebrada Grande was covered in primary forest. Presently, there is no primary forest left (or even secondary forest of any substance) within sight from the trails between Laguna del Cerro and Quebrada Grande, and a much larger area around Quebrada Grande has been denuded. Even the shade tolerant coffee farms prevalent between Laguna del Cerro and Quebrada Grande in 1988 had been converted to sun-resistant coffee fields by October 1998. Recent fieldwork along the southwestern portion of Montaña del Cerro Azul also demonstrated that no primary forests exist in that area as well, with the exception of some of the steeper slopes of the mountain. This habitat destruction and degradation, although serving to make available land for support of the local people, is disconcerting given the size and diversity of the documented herpetofauna, the number of endemic species supported by this biotic reserve, and the potential of the area to produce additional novelties for the country. Equally disconcerting is the lack of personnel and facilities in the park for its protection. Even many people living in this park apparently are unaware of its 'protected status'. Unless Parque Nacional Cerro Azul acquires such protection, it appears likely that the area will loose what remaining forests it has left.

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APPENDIX I - Specimen locality data

Bolitoglossa conanti.- Quebrada Grande, 1250-1600 m, KU 219840-91, MVZ 186762-63, 186767, 186769, 186772, 186777, UF 142380.

Bolitoglossa dofleini.- between Laguna del Cerro and Quebrada Grande, ca. 1300 m, SMF 78902; Quebrada Grande, 1250-1370 m, KU 202996, MVZ 221181-82, 225849-50, SMF 78901, UF 142389, 142393; San Isidro, 1040-1200 m, UF 142390.

Bolitoglossa dunni.- Quebrada Grande, 1370-1600 m, FMNH 236515-21, MVZ 186761, 186765-66, 186768, 186770-71.

Bolitoglossa rufescens.- between Laguna del Cerro and Quebrada Grande, 1000 m, SMF 78900; Quebrada Grande, 1250-1370 m, MVZ 186773, 186776, 225863, SMF 78891-94, 78896-99, UF 142381-82, USNM 333041-60, 343428-34; San Isidro, 1040 m, UF 142383-88.

Bufo campbelli.- Laguna del Cerro, 770 m, KU 209259; between Laguna del Cerro and Quebrada Grande, 810-1080 m, KU 209265-66.

Bufo valliceps.- Laguna del Cerro, 770 m, SMF 78500; between Laguna del Cerro and Quebrada Grande, 1250 m, SMF 78909; Quebrada Grande, 1250 m, UF 142406; San Isidro, 1040 m, UF 142410.

Hyalinobatrachium fleischmanni.- Laguna del Cerro, 770 m, KU 200525.

Agalychnis callidryas.- Laguna del Cerro, 770 m, UNAH 3776, USNM 514172-77.

Agalychnis moreletii.-Laguna del Cerro, 770 m, KU 200526-28; near Quebrada Grande, 1300 m, KU 200529-30.

Duellmanohyla soralia.- Quebrada Cañon Oscuro, 1050-1170 m, KU 195557-58 (both tadpoles), USNM 304991 (tadpoles), 514506-14, 514707-08 (both tadpoles); Laguna del Cerro, 770 m, USNM 508451 (tadpoles); Quebrada Grande, 1350-1370 m, KU 195554-55, SMF 78921, UNAH 3775, USNM 514515-20; San Isidro, 900-1060 m, UF 142532-33 (both tadpoles).

Hyla bromeliacia.- Cerro Los Dantos, 1600 m, USNM 523174-75; Quebrada Grande, 1250-1370 m, FMNH 236384, SMF 78920, UF 142376-77, USNM 304990 (tadpoles), 514710 (tadpoles), 523171-73, 523176-81, 523462 (tadpoles).

Hyla loquax.- Laguna del Cerro, 770 m, KU 200536, SMF 78914, UNAH 3778, USNM 514229.

Hyla microcephala.- Laguna del Cerro, 770 m, KU 200542, UNAH 3780, USNM 514245-51.

Hyla picta.- Laguna del Cerro, 770 m, USNM 514290-91.

Hyla salvaje.- Quebrada Grande, 1370 m, KU 195549-50, 195551-52 (both tadpoles).

Plectrohyla guatemalensis.- Quebrada Cañon Oscuro, 1150-1170 m, SMF 78770, USNM 514648 (tadpoles), 523190; Quebrada Grande, 1250-1370 m, KU 209685, 209706 (tadpoles), UF 142375, 142537 (tadpoles).

Plectrohyla matudai.- near Laguna del Cerro, 770 m,

USNM 523484 (tadpole); Quebrada Grande, 1370-1480 m, KU 195447 (tadpoles), 195448-51, 195453-54, 209711, UF 142536 (tadpoles), USNM 514421-23; San Isidro, 900-1060 m, UF 142362-68, 142534-35 (last two both tadpoles).

Ptychohyla hypomykter.- Quebrada Cañon Oscuro, 1150-1170 m, USNM 319918-19, 319938 (tadpoles), 514296-97, 514691 (tadpoles); Laguna del Cerro, 770 m, USNM 508453-55 (all tadpoles), 514298-99; Quebrada Grande, 1250-1600 m, KU 204204-09, 204212 (cleared and stained adult), 209712 (tadpoles), SMF 78916, UF 142370, 142539 (tadpoles), UNAH 2873, USNM 304992-94 (all tadpoles), 319920-22, 319937 (tadpoles), 508452 (tadpoles), 514300, 514325, 514684 (tadpoles); San Isidro, 900-1060 m, UF 142371-74, 142540-41 (last two both tadpoles).

Scinax staufferi.- near Quebrada Grande, 1300 m, UNAH 2881.

Smilisca baudinii.- Laguna del Cerro, 770 m, UNAH 3773, USNM 508476-77 (both tadpoles), 514453; Quebrada Grande, 1250-1370 m, KU 202999-3001, SMF 78925, UF 142426, UNAH 3772, USNM 304995 (tadpoles), 508475 (tadpoles), 514457-63; San Isidro, 1040 m, UF 142427.

Eleutherodactylus charadra.- Laguna del Cerro, 770 m, KU 209136; Quebrada Grande, 1250-1370 m, KU 209132-35, 209137, UF 142428; San Isidro, 900-1200 m, UF 142429-38.

Eleutherodactylus coffeus.- between Laguna del Cerro and Quebrada Grande, 1000 m, SMF 78873; San Isidro, 900-1200 m (a series of 11 uncatalogued specimens is considered conspecific with the holotype of *E. coffeus*, even though they differ in having a longer head more typical of other species in the *E. gollmeri* group. They do agree, however, with *E. coffeus* in all other diagnostic characters).

Eleutherodactylus laticeps.- Quebrada Grande, 1250-1300 m, UF 142397, USNM 525573; San Isidro, 1040 m, UF 142396.

Eleutherodactylus milesi.- between Laguna del Cerro and Quebrada Grande, 1050-1100 m, KU 209076-77; Quebrada Grande, 1350-1400 m, KU 209078-79, 209097.

Eleutherodactylus rostralis.- between Laguna del Cerro and Quebrada Grande, 1050-1200 m, KU 209109-12; Quebrada Grande, 1370 m, KU 209113; San Isidro, 980-1200 m, UF 142439-40.

Eleutherodactylus sp.- San Isidro, 900-1200 m (a series of seven specimens represent an undescribed species of the *E. alfredi* group).

Rana brownorum.- Laguna del Cerro, 770 m, KU 200557, USNM 508486 (tadpoles). 523728; Quebrada Grande, 1370 m, KU 203005, USNM 523729-36; San Isidro, 1040 m, UF 142447-48.

Rana maculata.- Laguna del Cerro, 770 m, SMF 78918, USNM 508490 (tadpoles); Quebrada Grande, 1360-1370 m, KU 200547-48, 200500, USNM 514749 (tadpoles), 523255.

Kinosternon leucostomum.- Laguna del Cerro, 770 m, USNM 559563.

Abronia montecristoi.- Quebrada Grande, 1370 m, USNM 520001.

Laemanctus longipes.- between Laguna del Cerro and Quebrada Grande, 1120 m, USNM 549415.

Sceloporus malachiticus.-Cerro Los Dantos, 1840 m, KU 200576; Quebrada Grande, 1250-1370 m, KU 200570-71, 200575, 203006.

Norops biporcatus.- Laguna del Cerro, 770 m, SMF 79147.

Norops capito.- Laguna del Cerro, 770 m, UF 142454; San Isidro, 1040 m, UF 142455-57.

Norops johnmeyeri.- Quebrada Grande, 1370-1480 m, KU 192624-25.

Norops laeviventris.- Quebrada Grande, 1250-1480 m, FMNH 236388, SMF 79179, USNM 532569.

Norops ocelloscapularis.- Quebrada Cañon Oscuro, 1150-1170 m, SMF 79091, USNM 529976-77; between Laguna del Cerro and Quebrada Grande, 1200 m, SMF 78841, 79077-78; Quebrada Grande, 1250-1370 m, SMF 79090, 79092, USNM 529973-75; San Isidro, 1040-1200 m, UF 142458-59.

Norops petersii.- Quebrada Grande, 1370-1400 m, KU 195463, UF 142395.

Norops rodriguezii.- Laguna del Cerro, 770 m, SMF 79086; near Quebrada Grande, 1250 m, SMF 79085; San Isidro, 900-1040 m, UF 142546.

Norops uniformis.- Laguna del Cerro, 770 m, SMF 79150-51; between Laguna del Cerro and Quebrada Grande, 1100 m, USNM 330185; Quebrada Grande, 1370 m, UF 142460-61; San Isidro, 1040 m, UF 142462.

Sphenomorphus cherriei.- Laguna del Cerro, 770 m, UF 142463; near Quebrada Grande, 1300 m, SMF 79144.

Ameiva festiva.- near Quebrada Grande, 1300 m, SMF 79142.

Lepidophyma flavimaculatum.- Quebrada Grande, 1250-1300 m, SMF 79115, UF 142464-66; San Isidro, 1040 m, UF 142467.

Lepidophyma mayae.- San Isidro, 1040 m, UF 142392 (this specimen constitutes the first known record of this species from Honduras).

Typhlops stadelmani.- Quebrada Grande, 1250-1370 m, SMF 79113, UF 142468-74, USNM 539989-40000.

Boa constrictor.- Quebrada Grande, 1370 m, based on 2.5 m adult that was released at site of capture.

Adelphicos quadrivirgatum.- Quebrada Grande, 1250-1370 m, KU 203088, UF 142475-84, USNM 561009; San Isidro, 1040 m, UF 142485.

Clelia clelia.- Laguna del Cerro, 770 m, FMNH 236395 (hemipenis only; adult discarded).

Coniophanes bipunctatus.- Quebrada Grande, 1370 m, USNM 508405.

Coniophanes fissidens.- San Isidro, 1040 m, UF 142487.

Coniophanes imperialis.- San Isidro, 1040 m, UF 142488.

Dryadophis dorsalis.- Quebrada Grande, 1370 m, USNM 508409; near San Joaquín, 1600 m, SMF 79135.

Dryadophis melanolomus.- San Isidro, 1040 m, UF 142489.

Drymobius chloroticus.- Quebrada Grande, 1370-1480 m, KU 200600, 200602-04, UF 142490.

Drymobius margaritiferus.- near Laguna del Cerro, 860 m, KU 200606; Quebrada Grande, 1370 m, KU 203008, USNM 508412.

Geophis fulvoguttatus.- near Quebrada Grande, 1680 m, KU 214782.

*Imantodes cench*oa.- Quebrada Grande, 1250-1370 m, KU 200607, ROM 19978-79, SMF 79121, UF 142491; San Isidro, 1200 m, UF 142492.

Lampropeltis triangulum.- Quebrada Grande, 1250-1370 m, ROM 19980-81, UF 141975, 142071, USNM 508417-18; San Isidro, 1040 m, UF 142072-73.

Leptodeira septentrionalis.- Quebrada Grande, 1250-1370 m, UF 142494, USNM 508420.

Ninia diademata.- Quebrada Grande, 1250-1370 m, SMF 79125, UF 142495-503, USNM 508422.

Ninia espinali.- San Isidro, 1040 m, UF 142504-05.

Ninia sebae.- Quebrada Grande, 1250 m, UF 142507-11.

Pliocercus elapoides.- Quebrada Grande, 1250-1370 m, FMNH 236406, UF 142512-13; San Isidro, 1040 m, UF 142514.

Rhadinaea kinkelini.- Quebrada Grande, 1250-1370 m, KU 203089, UF 142515; San Isidro, 900 m, UF 142516.

Rhadinaea montecristi.- Cerro Los Dantos, 1600 m, KU 203090; Quebrada Grande, 1370 m, KU 203091-92; near San Joaquín, 1600 m, USNM 508423.

Sibon dimidiatus.- Quebrada Grande, 1300-1400 m, KU 200612, ROM 19987-89, SMF 79119; San Isidro, 1200 m, UF 142077-79.

Sibon nebulatus.- Quebrada Grande, 1250 m, UF 142518.

Stenorrhina degenhardtii.- Quebrada Grande, 1250-1370 m, KU 200613, ROM 19990-94, UF 142520-21, USNM 508426-28; San Isidro, 1040 m, UF 142522-23.

Tantilla impensa.- Quebrada Grande, 1370-1600 m, FMNH 236413, SMF 79114, USNM 523955.

Tantilla schistosa.- Quebrada Grande, 1250-1370 m, KU 203093, ROM 19995, USNM 561062-63; San Isidro, 1040 m (this series may contain two species, as one of three uncatalogued specimens collected in 2004 and two of the three museum specimens listed have a head pattern similar to that of the closely related *T. alticola* of southern Central America).

Micrurus diastema.- near Laguna del Cerro, 830 m, KU 200628; Laguna del Cerro, 770 m, SMF 79108; Quebrada Grande, 1250-1680 m, KU 200629, ROM 20010, UF 142525-28, USNM 508431-32, 561075, 561123 (eggs); San Isidro, 1040 m, UF 142529.

Atropoides mexicanus.- Quebrada Grande, 1250-1300 m, KU 203011, SMF 79117, UF 141977, 142074.

Bothriechis thalassinus.- Quebrada Grande, 1250-1600 m, KU 203094, ROM 20015, UF 142530, USNM 561092.

Bothrops asper.- Quebrada Grande, 1300 m, KU 200621.

APPENDIX II - Gazetteer

Cañon Oscuro, Quebrada - a deep canyon stream that flows from Quebrada Grande southwestward into Laguna del Cerro; collections made from 1100 to 1250 m (15°05'N, 88°56'W).

Cerro, Laguna del - a small lake in SW portion of park; 770 m (15°05'N, 88°56'W).

Cerro Azul, Montaña del - highest peak in park, nuclear zone of park lies at 1600 m and above on slopes of this mountain; 2285 m (15°07'N, 88°55'W).

Dantos, Cerro Los - peak SE of Quebrada Grande near southeastern boundaries of nuclear zone; collections made from 1370 to 1840 m (15°05'N, 88°54'W).

Quebrada Grande - a village S of highest peak of Montaña del Cerro Azul; 1250 to 1370 m (15°05'N, 88°55'W).

San Isidro - a small village on W flank of Montaña del Cerro Azul; 1040 m (15°07'N, 88°56'W).

San Joaquín - a village SSE of Quebrada Grande, where foot trail to Quebrada Grande begins; 1500 m (15°04'N, 88°55'W).