KEVIN M. ENGE

Anolis (*Norops*) *johnmeyeri* is a large anole found in the elfin forests of Cusuco National Park, Honduras.

Denizens of the Dwarf Forest: The Herpetofauna of the Elfin Forests of Cusuco National Park, Honduras

Josiah H. Townsend[1] and Larry David Wilson[2]

[1]Division of Herpetology, Florida Museum of Natural History, Gainesville, Florida 32611-7800, USA (jtownsend@flmnh.ufl.edu)
[2]Department of Biology, Miami Dade College, Kendall Campus, Miami, Florida 33176-3393, USA (lwilson@mdc.edu)

It is hard to explain this transition to what looks like an arid-land flora on these high peaks which receive a maximum of water supply through condensation of moisture from the nearly continuous winds, unless it be that the stronger winds augment the hazard in a temporary failure of the moisture supply. These scant-leaved, dwarfed, and wind-tortured trees are often little more than framework for the support of masses of air plants, and a tree that at first glance appears to be alive may be nothing but a corpse, completely enshrouded by the epiphyte flora that killed it.

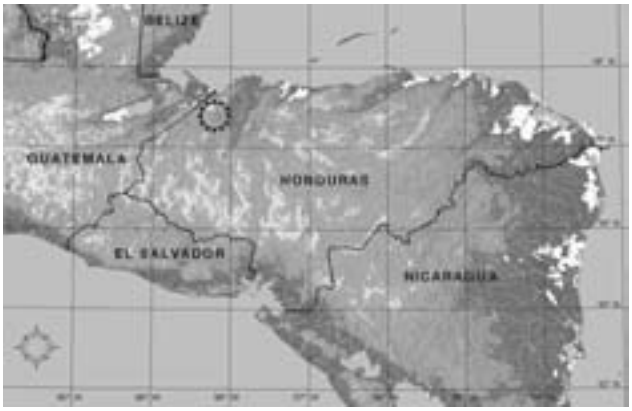
Archie F. Carr, Jr., 1953

With these words, Archie Carr introduced readers to a poorly known and intriguing vegetative formation that even he was rarely able to visit. Shrouded in mist, atop the highest peaks of the Sierra de Omoa, lies a unique form of forest akin to that described by Carr, a place as enchanting as it is mysterious. This forest is referred to by local residents as the *bosque enano*, meaning "dwarf forest" or "elfin forest" in Spanish. Those fortunate enough to experience it are forever enamored by the stunning vistas, crisp air, and the luxuriant carpet of epiphytic organisms that are characteristic of this unique mountaintop habitat. Whereas the dwarf forest is home to only a handful of herpetofaunal species, those amphibians and reptiles that have managed to gain a foothold there include some of the more unusual and specialized species found anywhere in Mesoamerica.

The Sierra de Omoa is an isolated mountain range found in the northwestern corner of the Central American republic of Honduras. Although one of Honduras's largest and fastest growing cities, San Pedro Sula, sits in an alluvial plain at the foot of the mountains, the upper regions of this range support a sizable cool cloud forest that is protected within the boundaries of Cusuco National Park, seemingly a world away from the heat and commotion of the country's financial capital.

Cusuco National Park is one of the herpetologically best-known cloud forest reserves in Honduras. Seventeen species of amphibians and 33 species of reptiles have been recorded. Of these, nine are found nowhere else in Honduras (or the world for that matter), and another nine are found only in the Sierra de Omoa and the associated northwestern highlands of Honduras and adjacent Guatemala. The high degree of endemism demonstrated by the herpetofauna of Cusuco National Park indicates the critical conservation value of these forests, and the importance of the park as a framework for protecting the unique biota of the Sierra de Omoa.

Perhaps the most distinctive habitat formation found in these mountains is the dwarf forest, which is restricted to the



Honduras is located in Central America; the general location of Cusuco National Park and the dwarf forests is marked with a circle.

BROOKE L. TALLEY

Heather wind scrub formation, around 2000 m elevation, on top of Cerro Cusuco, July 2005.

JOSIAH H. TOWNSEND

Peak of Cerro Cusuco, about 2100 m elevation, as seen from Cerro Jilinco.

DAN PUPIUS

Hepatic or mossy forest formation, around 2050 m elevation, Cerro Jilinco, September 2004.

windswept upper slopes of Cerro Cusuco and Cerro Jilinco, the highest peaks in the Sierra de Omoa, above around 1950 m elevation. The term "dwarf forest" has been used to describe a variety of mountaintop vegetation formations in the Neotropics. In the Sierra de Omoa, this term is used to refer to two formations: the hepatic or mossy forest and the heather wind scrub. These formations were broadly defined initially by Archie Carr in 1950 and later by D. Mejía V. Subsequent authors have applied the terms specifically to the dwarf forests of Cusuco National Park. Both the hepatic or mossy forest and the heather wind scrub are typified by short vegetation (canopy <10 m high) and an overwhelming abundance of epiphytes, including giant ground-dwelling bromeliads, arboreal bromeliads, mosses, hepatics, lichens, orchids, mistletoe, and fungi.

JOSIAH H. TOWNSEND

Heather wind scrub formation, around 2060 m elevation, on top of Cerro Jilinco, March 2006.

The heather wind scrub is found on the highest peaks and exposed ridges of Cerro Cusuco and Cerro Jilinco. As the name indicates, this vegetation formation is dominated by heathers (Ericaceae), with the tallest vegetation rarely exceeding 2 m in height. Hepatic or mossy forest is found just below the heather wind scrub, and has more trees, which seem to have every available inch of their trunks and limbs occupied by epiphytic growth. These two formations occupy less than 1 km^2 within the park, yet are so distinctive from the cloud forests below as to deserve special attention from researchers and conservation practitioners alike.

Not surprisingly, such a restricted high-elevation habitat that is at least 100 m in elevation above any permanent water source is home to a relatively small number of reptilian and amphibian species. Studying the herpetofauna of the dwarf forest is rendered more complicated by the lack of suitable campsites and available drinking water, as well as by the remoteness and relative difficulty of accessing the peaks of these mountains. During 2004, 2005, and 2006, the authors or other herpetologists working as part of the Operation Wallacea Honduras Forests Conservation Project visited the Cusuco dwarf forests seven times. Most of these visits were made during the daytime and involved a two to four hour trek to a dwarf forest site, a few hours of searching for reptiles and amphibians, and the return trek. On two occasions, small campsites were set up below the dwarf forest to facilitate searches of the habitat at night. In addition to the results of our visits to the dwarf forest, two records were obtained by Mario R. Espinal during his work in Cusuco National Park.

Four species of lizards have been recorded in the dwarf forest: the anguid *Mesaspis moreletii*, the anoles *Anolis johnmeyeri* and *A. amplisquamosus*, and the spiny lizard *Sceloporus schmidti*. The Alligator Lizard *Mesaspis moreletii* is a terrestrial, viviparous lizard found at intermediate and high elevations in isolated highland areas from Chiapas, Mexico, to northwestern Nicaragua. The ability to give birth to its young live rather than laying eggs

KENNETH L. KRYSKO

Flowers of an unidentified Ericaceae on Cerro Jilinco, a dominant plant in the heather wind scrub.

BROOKE L. TALLEY

Hepatic or mossy forest formation, just below 2000 m elevation on Cerro Cusuco.

DAN PUPIUS

The senior author ducking through the dense vegetation at about 2000 m elevation, near the top of Cerro Cusuco, August 2005.

BROOKE L. TALLEY

Dougie Fraser (left) and the junior author at a remote campsite below the dwarf forest on Cerro Cusuco, about 1870 m elevation.

is a hallmark of lizards that are adapted for life at high elevations, where ambient temperatures may not be high enough to naturally incubate eggs. *Anolis* (*Norops*) *amplisquamosus* is an anole known only from intermediate elevations of Cusuco National Park in the Sierra de Omoa of northwestern Honduras, and is one of many species that are endemic to the park. It is easily recognized by having 8–10 rows of greatly enlarged scales along the middorsal line. *Anolis* (*Norops*) *johnmeyeri* is a large anole found only at moderate and intermediate elevations on the Atlantic versant in western Honduras. This striking species is unusual in that both males and females have large dewlaps with a blue central spot; males have the blue spot surrounded by red and in females it is surrounded by yellow. The Emerald Swift, *Sceloporus schmidti*, is a spectacularly colored Spiny Lizard distributed at low, moderate, intermediate, and high elevations from western Honduras to western Panamá. This species is a common cloud forest inhabitant throughout its range, and can be found in exposed areas that receive the most exposure to sunlight, making the short vegetation of the dwarf forest an ideal habitat for this species.

Only two snakes are known from the Cusuco dwarf forests, the colubrid *Ninia espinali* and the montane pitviper *Cerrophidion godmani*. *Ninia espinali* is a small, semifossorial snake found at intermediate elevations from northwestern Honduras southward to southwestern Honduras; it is also known to occur in extreme northwestern El Salvador. Named for the Honduran biologist Mario R. Espinal, a single specimen

KEVIN M. ENGE

BROOKE L. TALLEY

The Alligator Lizard *Mesaspis moreletii* gives birth to live young rather than laying eggs, a hallmark of lizards that are adapted for life at high elevations.

of *N. espinali* was collected by Mario near the peak of Cerro Jilinco. *Cerrophidion godmani* is a pitviper distributed at occasionally moderate to high elevations in disjunct populations in Oaxaca and Chiapas, México, Guatemala, El Salvador, Honduras, northern Nicaragua, central Costa Rica, and western Panamá. This species is another that is typical of cloud forest habitats throughout its range, and can be locally abundant in areas where it is not persecuted by humans.

Two salamanders have been recorded in the Cusuco dwarf forest, *Bolitoglossa diaphora* and *Cryptotriton nasalis*, both plethodontids. *Bolitoglossa diaphora* is endemic to intermediate elevations in northwestern Honduras and is another species restricted in distribution to Cusuco National Park. This species demonstrates a high degree of sexual dimorphism with respect to its color pattern; males are typically dark gray, whereas females are mottled orange, red, yellow, and brown. *Cryptotriton nasalis* is endemic to moderate and intermediate elevations of northwestern Honduras, and it is known from localities outside of Cusuco National Park in the Sierra de Omoa. These tiny salamanders derive their name from their large nostrils, which can approach the size of their eyes. In the dwarf forest, this species is found inside bromeliads. Only one species of frog is known to occur in the dwarf forest, the recently described bromeliad-dwelling *"Hyla" melacaena*. This species is endemic to the Sierra de Omoa. An adult female was discovered as it hopped from a bromeliad as a field crew brushed past, and these frogs are suspected to breed in the water-filled axils of arboreal bromeliads.

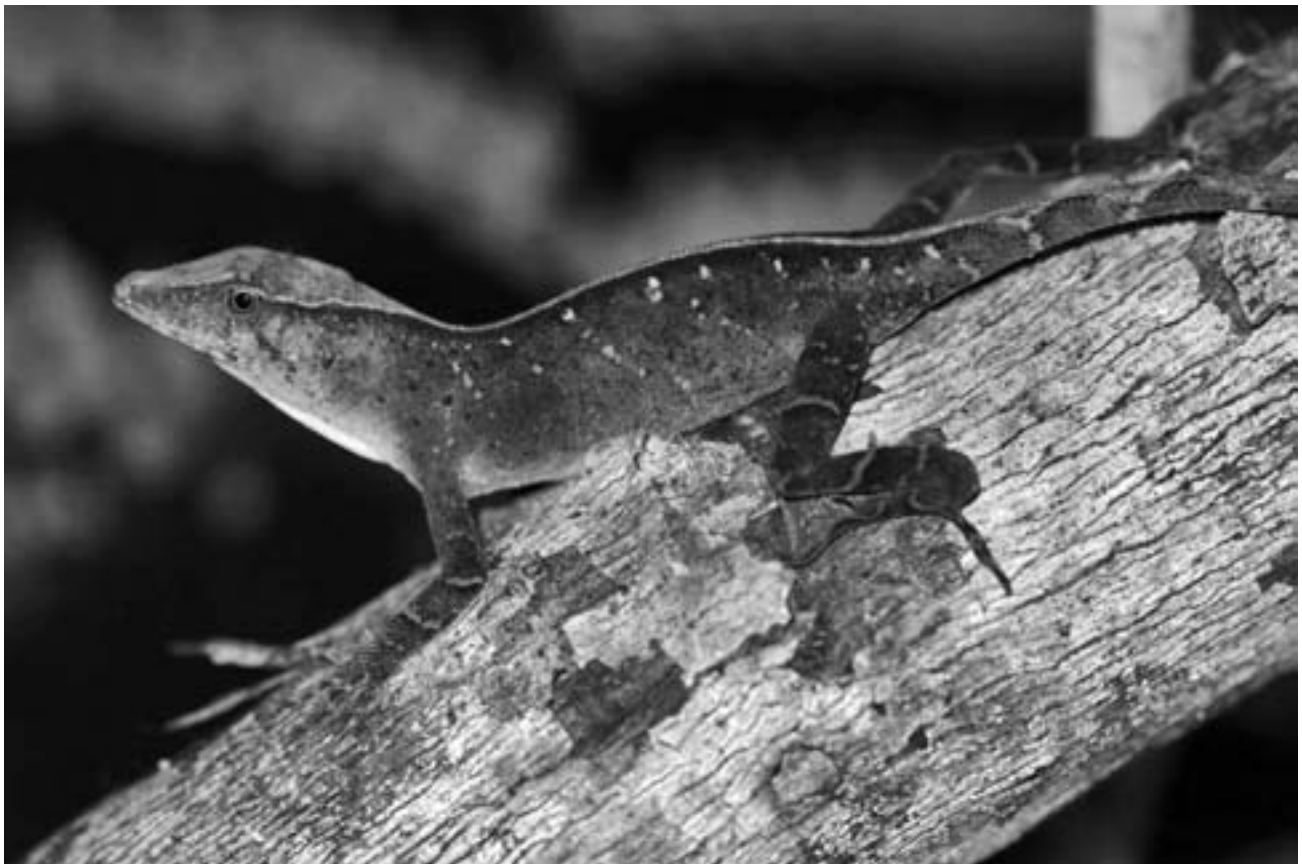
Although the known herpetofauna of the Cusuco dwarf forests is extremely limited, it is also quite significant, inasmuch as five of nine species of amphibians and reptiles are endemic to Honduras (*Anolis amplisquamosus, A. johnmeyeri, Bolitoglossa diaphora, Cryptotriton nasalis*, and *"Hyla" melacaena*) and another species (*Ninia espinali*) is a near-endemic, having been otherwise found only in extreme northwestern El Salvador. These nine species represent 18.0% of the 50 species known to inhabit Cusuco National Park. That such territorially limited yet inter-

BROOKE L. TALLEY

KENNETH L. KRYSKO

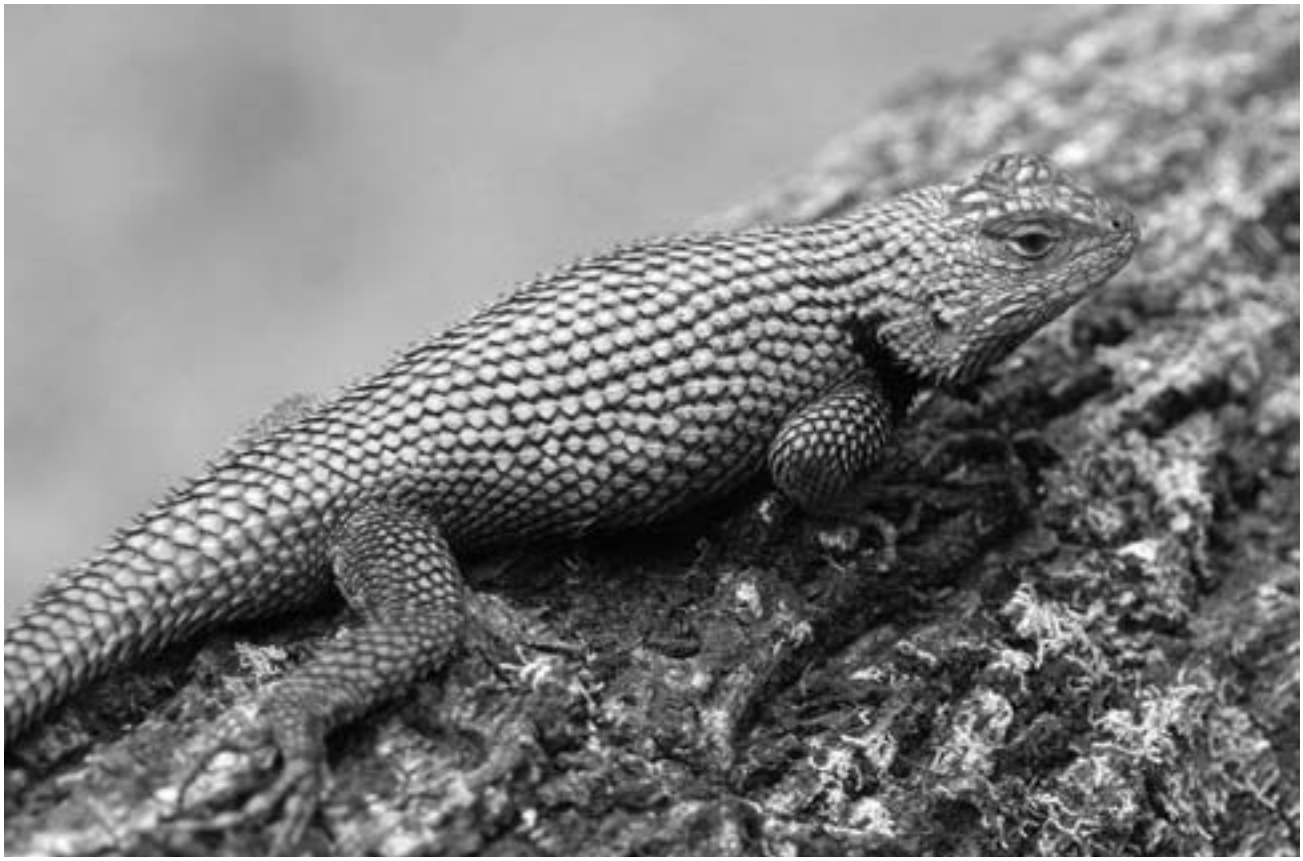
Anolis (*Norops*) *amplisquamosus* is one of many species that are endemic to Cusuco National Park.

JOSIAH H. TOWNSEND



KEVIN M. ENGE

Anolis (*Norops*) *johnmeyeri* is a large anole that is unusual in that both males and females have large dewlaps with a blue central spot; males (top) have the blue spot surrounded by red and in females it is surrounded by yellow (bottom).



DAN PUPIUS

JOSIAH H. TOWNSEND

The Emerald Swift (*Sceloporus schmidti*) is a common cloud forest inhabitant throughout its range, and can be found in open areas that receive the most exposure to sunlight.

JOSIAH H. TOWNSEND

The colubrid *Ninia espinali* is a small, semifossorial snake found at intermediate elevations.

JOSIAH H. TOWNSEND

KEVIN M. ENGE

The Pitviper *Cerrophidion godmani* is another species that is typical of cloud forest habitats throughout its range, and can be locally abundant in areas where it is not persecuted by humans. The right-hand photo is a juvenile.

esting habitat contains an equally limited yet interesting herpetofauna is fitting. What other secrets might be hidden in the windswept, cloud-drenched world at the top of the Sierra de Omoa? Only further exploration of Cusuco's dwarf forests can provide any semblance of an answer to this question — but we can say with certainty that the dwarf forest is one of the most fascinating and endearing places in which we have had the privilege of working; a magical little world shrouded in clouds and mystery.

Acknowledgments

Makrín Ramírez, René Alvarenga, Danílo Alvarenga, Roger Alvarenga, Mino Cortés, Marina Alvarenga, Brooke L. Talley, T. Lynette Plenderleith, Dougie C. Fraser, Sara M. Hughes, Dan Pupius, Zia Lewindson, Kenney L. Krysko, and Kevin M. Enge provided assistance in the field. Our work was conducted under permits granted by Conrado Gonzáles, Carla Cárcamo, Martha Moreno, and Ibrahim Padilla of COHDEFOR and DAPVS in Tegucigalpa, Honduras. Funding for various trips to Cusuco National Park was provided by Operation Wallacea, the Tropical Conservation and Development Program at the University of Florida, the Herpetology Division of the Florida Museum of Natural History, and the Reptile and Amphibian Conservation Corps. We thank Brooke Talley, Dan Pupius, Kevin Enge, and Kenney Krysko for use of their photographs.

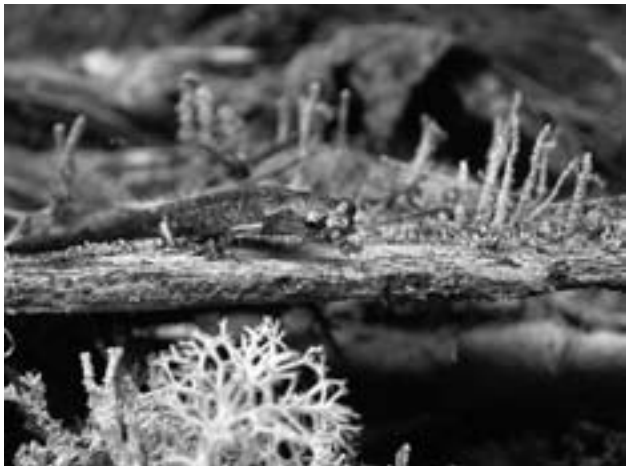
References

Carr, A.F., Jr. 1950. Outline for a classification of animal habitats in Honduras. *Bulletin of the American Museum of Natural History* 94: 567–594.

JOSIAH H. TOWNSEND

KENNETH L. KRYSKO

Bolitoglossa diaphora demonstrates a high degree of sexual dimorphism in color pattern; males are typically dark gray, whereas females are mottled orange, red, yellow, and brown.



BROOKE L. TALLEY

Tiny *Cryptotriton nasalis* derive their name from their large nostrils, which can approach the size of their eyes.

Carr, A.F., Jr. 1953. *High Jungles and Low*. University Press of Florida, Gainesville.

McCranie, J.R. and F.E. Castañeda. 2006. A new species of hylid frog from northwestern Honduras. *Herpetologica* 62: 318–323.

Mejía V., D.A. 2001. Honduras, pp. 243–282. *In* M. Kappelle and A.D. Brown (eds.), *Bosques Nublados del Neotrópico*. Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica.

Townsend, J.H. 2006. Inventory and conservation assessment of the herpetofauna of the Sierra de Omoa, Honduras, with a review of the *Geophis* (Squamata: Colubridae) of eastern Nuclear Central America. Unpublished Master's Thesis, University of Florida, Gainesville.

Townsend, J.H., and L.D. Wilson. In press. *Guía de los Anfibios y Reptiles de Parque Nacional Cusuco, Honduras. Guide to the Amphibians and Reptiles of Cusuco National Park, Honduras*. Bibliomania, Salt Lake City, Utah.

Townsend, J.H., L.D. Wilson, B.L. Talley, D.C. Fraser, T.L. Plenderleith, and S.M. Hughes. 2006. Additions to the herpetofauna of Parque Nacional El Cusuco, Honduras. *Herpetological Bulletin* 96: 29–39.

Wilson, L.D., and J.R. McCranie. 2004. The herpetofauna of Parque Nacional El Cusuco, Honduras. *Herpetological Bulletin* 87: 13–24.

DAN PUPIUS

The recently described bromeliad-dwelling frog *"Hyla" melacaena* is the only species of frog known to occur in the dwarf forest. This species is endemic to the Sierra de Omoa. This adult female was discovered as it hopped from a bromeliad as a field crew brushed past, and this species is suspected to breed in the water-filled axils of arboreal bromeliads.