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Where Are They?



Snakes, such as this *Oxybelis fulgidus*, are common in the forest, but can be very hard to see. Photo by Bill Magnusson.

While research was deepening our knowledge of lizards, where snakes were when they weren't making brief appearances in our World remained a mystery. This was just curiosity about the majority of snakes, but of practical significance in the case of venomous species. Even when a snake bit someone and they killed it, the victim did not seem to see the snake very well. I hadn't been in the Amazon very long when I took a trip up river. Our guides said that a boy who lived in one of the scattered houses along the bank had been bitten by a snake and we went to see if we could be of help.

The lad was about 12 years old and his father said that he had been bitten by a surucucu, which is the local name for the bushmaster¹⁷⁶, the largest and most feared snake in the Amazon. I had seen one in Reserva Ducke and was impressed by its size. Its head was as big as my clenched fist and curled up it looked like a huge Mexican hat thrown on the ground. Unlike most snakes, its scales overlapped little and were knobby, like a cobbled road. It did nothing as I sat in front of it to take a photograph, but I had heard that they could strike half their body length, which in this case would have been about a meter and half. They often strike above the knee, which makes snake gaiters useless, and their fangs leave puncture wounds several finger widths apart.

I looked at the boy's leg, which was badly swollen and slightly yellowish around the puncture marks that were just above his ankle. They were exuding a transparent reddish liquid and he was obviously in great pain. His relatives were preparing a boat to take him to a hospital, many hours away, where he could receive antivenom. However, I doubted that the bite was from a bushmaster. Although a baby of that species might be able to leave punctures so close together, I had never, and still haven't, heard of anyone being bitten by a baby bushmaster. Therefore, I told the stricken parents to wait while I went to see if I could find the snake that the boy said he had killed.



Photo 15.1 A bushmaster, *Lachesis muta*, looks like a big Mexican hat thrown on the ground when curled up. Individuals may remain in the same place for weeks at a time.
Photo by Bill Magnusson.

His father took me to where the incident had occurred but I didn't like my chances of finding the snake as it had been several hours since the boy was bitten and the snake might have recovered and crawled away or scavengers could have taken the body. We crossed a fallow field and entered into low regrowth forest with lots of understory plants and deep leaf litter. The father pointed to where the snake had been, but at first I couldn't see it because it was lying in an almost life-like position. The mottled browns and yellows of its back made it blend in with the fallen leaves and I could see why the boy had stepped on it.

When I picked it up, it squirmed, either in death throws or post-mortem twitches. I was careful not to get within striking distance of the head, but the snake had been cut almost in half by a machete. It was only the thickness of my thumb and, obviously, a lance-head viper and not a bushmaster. I gave the snake

to the boy's father, told him to show it to the doctors, and to tell them to give him lance-head and not bushmaster antivenom.

I was used to Australia, where snake bite and snake-bite death are rare events. In South America, thousands of people are bitten by vipers, and hundreds die every year. Vipers tend to have venom that destroys tissues locally rather than causing complete nervous-system collapse, as is the case for many Australian elapids. That means that, although they cause debilitating tissue necrosis, on average they are probably less likely to kill you than Australian snakes.

South American vipers kill so many people for two reasons. The first is that, unlike most elapids, they rely on camouflage rather than movement to avoid being killed by other predators. It is therefore very easy to step on one, especially if you are intent on another activity, such as clearing land with a machete. The second reason is that many poor people in South America live far from reliable transport systems and even further from hospitals with antivenom. Most snake-bite deaths in South America happen because the victim did not get to hospital in time.



I do not use snake garters, I am too wimpy to walk long distances in rubber boots, and I generally don't use shoes when I am in the forest. Knowing the density of vipers in Reserva Ducke and other places where I work, and how well camouflaged they are, I often wonder why I have never stepped on a snake and been bitten. Most Indians used to wander around the forest without shoes and very few of them were bitten considering the amount of time they spent in places literally crawling with snakes. An incident in Reserva Ducke gave me a clue to a possible reason.



*Photo 15.2 Lance-head vipers, like this *Bothrox atrox*, are well camouflaged when curled up on fallen leaves and it is easy to tread on one, especially if you are concentrating on something else. Photo by Bill Magnusson.*

I was walking down a track and my girlfriend was following. She stopped a little behind me and said in Portuguese “Why didn’t you tell me the snake was there?”

I asked “What snake?”

She replied “That lance-head viper you just stepped over!”

I looked at the ground and saw the meter-long lancehead viper stretched across the track I had just passed and said “I’m sorry, I didn’t see it.”

Angrily, she said “Don’t tell me that! I saw your foot was coming straight down on it and you altered your stride to step over it.”

Of course I just put it down to her imagination and, like many male partners before me, I just let her have her opinion to avoid discussing something in the past that could no longer be proven. Many years later, I read books about our unconscious brain¹⁷⁷, and I am no longer so sure that she was wrong.

The unconscious part of the brain that does most of the important things for us, such as telling us when to breathe or when to blink, can process millions of bits of information per second. The conscious brain that we use to make rational decisions can only process dozens of bits of information per second. Therefore, we may use the conscious brain to decide when and where to walk, but the act of walking is governed by the unconscious brain. It makes all the decisions, and more importantly it does not tell us about them.

The classic experiments have been carried out on blind people who have had the vision areas of the brain destroyed by strokes or other catastrophes, but whose eyes and their connection to the hind brain, where much of our unconscious resides, were unaffected. Those people firmly believed that they could not see, but if tricked to walk down a corridor that they have been told has no obstacles, they steer around things they can't see that are put in front of them. That is, their conscious brain can't see, but their unconscious brain can. It uses the information, but does not communicate it to the conscious brain.



Photo 15.3 Bill Magnusson and Guilherme Mourão in the Pantanal in 1987. Bill has been walking around Brazilian wilderness areas barefoot for more than 35 years and has never stepped on a snake. Photo by Zilca Campos.

Could it be that my unconscious brain saw the snake, made my feet deviate, but didn't tell me about it? Could that be part of the reason that we see so few snakes? Humans are born with an aversion to snake-like forms; they don't have to learn that fear rationally. Could it be that avoiding treading on snakes is so important, like breathing and making your heart beat, that the function was transferred to the unconscious brain long ago in our evolution and that is why we consciously see so few snakes?



Most poor people are bitten by snakes because their need to make a livelihood puts them into a position that neither they nor the snake wanted. In contrast, most richer people get bitten when they do something stupid. I am no exception. The only time I have been bitten by a viper was when I was showing someone how to catch a snake without getting bitten.

Barbara Mann, a thin blonde Canadian, visited Manaus in 1988 and went to Reserva Ducke to help with several research projects. As with all my helpers, I told her not to mess with vipers because it would upset them and they might bite the next person who came along. However, I made no restrictions about other species.

It was late at night and I had just laid down to sleep in our shelter on the banks of Acar á stream when Barbara walked in and asked if I could identify a snake for her. I was already starting to drift off and I grumpily told her to tie the bag to the rafters and I would look at the snake in the morning. There was a lot of work to be done and for some reason the next day I didn't look at the bag that was strung among other equipment. It was only when I woke up a day later that I looked up and saw the plastic bag and the distinctive yellow tail on the little snake; Barbara had caught a lance-head viper.

I was angry and I stormed down to the stream where Barbara was taking a bath. I said "Didn't I tell you not to catch vipers?"

She replied "Oh! I didn't know; it was so calm."

I said "They might look calm because they just sit there, but vipers are so fast that sometimes people don't even see when they are bitten."

Barbara said "Oh! So that's what happened. I thought that I was bitten by an ant when I was catching the snake." She then held up her hand, which was swollen, a nasty yellow color, and with purple bands on the joints.



Photo 15.4 *Thirty years later, Bill's finger still shows the effects of a bite by a tiny lancehead viper. Photo by Bill Magnusson.*

I said that it was too late to take antivenom and that it was good that it was a little snake because the babies usually had more neurotoxins than chemicals that cause necrosis. Otherwise, she might have lost a finger. I told her to come up to the camp and I would show her how to catch any snake from then on.

When Barbara was ready, I shook the little snake out of the bag onto the sandy soil. It curled up and assumed a striking stance. I pinned it behind the head with a stick held in my right hand. As I am right handed, that was my first mistake. It meant that I would have to pick it up with my left hand. I then grabbed it behind the head with my thumb and middle finger, with my forefinger on top of its head. When I looked up to explain to Barbara how to do it, the little snake squirmed around in the soft sand and drove one its fangs under the fingernail of my index finger.

As Barbara hadn't suffered any severe necrosis I figured that I wouldn't need antivenom, but a black blister formed on the tip of my finger, which gave me severe pain for several days, and I ended up losing half my finger nail. If you want lessons on catching venomous snakes, just ask me and I'll find someone else to help you!



We knew that snakes could be nearby without anybody noticing them. Our shelter was only a few meters from the stream and a lance-head viper took up residence among the bushes between the water and the poles we had erected to support hammocks. It did not try to hide, but just sat curled up on the leaf litter. As some of our visitors were desperately afraid of snakes we figured it would be best not to tell them about our scaly friend. None of the visitors saw it, and we would often have to look carefully to see it even though it was completely exposed on the leaf litter. It was obvious that if we wanted to work out how much time the snakes spent exposed on the surface and how often they were in underground dens we would need something other than our eyes to find them.

An opportunity came when Clarence L. Abercrombie III, better known just as Ab, came to work at INPA. Ab was in his forties, thin haired and with an ever-present engaging grin. He was from South Carolina, and in every way a southern gentleman. He talked quietly, listened attentively, and enjoyed nothing more than helping other people learn about biology. He exuded goodness, and I often found myself thinking "I wish I could be like that." I hope that at least a little of his benevolence rubbed off.



Photo 15.5 Clarence (Ab) Abercrombie and Thierry Gasnier measuring the temperature of a baby caiman in July 1987. Ab's help was critical for our radio-telemetry studies of snakes. Photo by Bill Magnusson.

Ab brought radio transmitters and had experience working with snakes in the USA. Snakes do not have a good body form for fixing transmitters, so you have to implant them surgically. This takes a lot of skill and experience because the transmitter has to be where it won't interfere with the snake's movement or feeding and the antenna has to be strung along the snake's body under its skin. If Ab hadn't come to help us, I am sure that we never would have studied snake movements.

We started with arrow-head vipers near our camp in Reserva Ducke. We caught two, took them back to the laboratory in Manaus and Ab surgically implanted the radios. I was impressed by the way he handled the snakes. No grasping them around the neck; he just induced them to enter a narrow pipe. The snake could then be pushed forward and it couldn't turn around to bite you or get

into a striking position. We kept them a few weeks to make sure that they had healed and were feeding normally before releasing them where we caught them.

The snakes seemed to have been little affected by the experience and curled up close to where we released them. From then on, they spent most of the time immobile, only moving from one ambush site to another every few days. Even with the radio signal indicating that the snake was close by, we often had difficulty seeing it sitting on the leaf litter, and we always worried that we might step on a snake before seeing it. The trick was to point the receiving antenna at the ground directly in front of you and then raise it slowly. If the snake was still far to the front, the signal would get louder as you lifted the antenna. If it were directly in front of you, the signal would get weaker as you lifted the antenna.

I was tracking one of the snakes and using the lifting trick to see how far away the snake was. As I lifted the antenna, the signal got louder so I took a few steps forward, but then the signal dropped to almost imperceptible. I turned around and when I lifted the antenna the signal increased, but two steps further on, it faded out again. Perplexed, I turned around and repeated the process, but this time I bumped the palm leaf that was over the trail. This caused the snake to fall off the leaf onto my shoulder and to the ground, whereupon it slithered off quickly. Each time I had turned around I had ducked under the leaf and my head must have been only a few finger widths from the snake! From then on, I made sure that if the signal got stronger when I lifted the antenna it wasn't because the snake was perched above ground.

We followed few snakes, but the results were important for another study¹⁷⁸, because they showed that the lance-head vipers spent much more time away from the streams than our casual observations had indicated. They also showed that the number of times we registered their presence was very small in relation to the number of times that we were near them. Lance-head vipers have a reputation for aggressiveness, but that, fortunately, is a myth.



Photo 15.6 Unlike the common arrow-head viper, *Bothrops atrox*, *Bothriopsis taeniata* spends most of its time above ground in low bushes and trees. It does not occur in Reserva Ducke. Photo by Bill Magnusson.

We were fairly relaxed around the vipers at Reserva Ducke. We knew that we could be bitten, but there was a hospital and antivenom close by. In any case, despite the possibly disfiguring local effects, you were very likely to survive. When Thierry Gasnier was bitten by a small lance-head viper during his lizard work, he showed only moderate symptoms and I suggested that he not take antivenom because of the possible allergic reactions and he just remained under observation in the hospital. The next day he was fine, but his girlfriend was a wreck because she stayed awake the whole night to make sure that he was still breathing!

The situation was different at Alter do Chão, however. There, the most common vipers were tropical rattlesnakes¹⁷⁹. They can cause nasty necrosis, but also have neurotoxins on par with those of the Australian elapids. If bitten by one, without antivenom, you will probably die. Tânia Sanaiotti, a student

studying birds on the peninsula, had obtained dried polyvalent antivenom, which we kept at Alter do Chão, but often the antivenom was unavailable or out of date.

We didn't find many rattlesnakes, which were more common on the borders of the forest than in the open savanna where we mainly worked, but whenever we came across one we treated it with utmost respect. We sometimes caught them to send to the Butantan Institute for antivenom production and decided to put a radio in one to see where it went.

The rattlesnakes apparently needed to drink water during the dry season, which meant crossing up to 60 m of beach. I went to the beach to bathe one night and, because there was a new moon, I didn't take a light. As I walking back to camp, I passed someone going the other way with a head light and they stopped and pointed to a large rattlesnake stretched across the path that I must have stepped over thinking it was a stick, though perhaps my unconscious knew what it was.

I nervously lifted the snake into a cloth bag using a stout stick. Fortunately, it was very cooperative because I wasn't about to pin it and pick it up. We would take it back to Manaus to implant a radio. The snake could easily bite someone through the bag, so I put it in a large can used for storing biscuits. However, I didn't want to leave the can out because the military used the area for survival training and their recruits had previously raided our camp for food. I didn't want a young soldier being sent home in a box just because he was hungry and tried to steal food, so I asked Renato Cintra if I could leave the snake overnight in the tent he was sharing with his girlfriend.



Photo 15.7 A tropical rattlesnake, *Crotalis durissus*, in the undergrowth at Alter do Chão. The diamond pattern reflects in the flash, but the snakes are very difficult to detect unless they rattle their tails. Photo by Bill Magnusson.

Later, Renato emerged bleary eyed and edgy. He said in Portuguese “As soon as I got to bed beside the snake in the metal box, it started rattling its tail as they usually do at night. I knocked the box to make it stop, ... but it didn’t, and after the third time I ask her to stop, she still kept rattling, so you can sleep with the snake.”

I replied in Portuguese “But Renato, rattlesnakes only rattle their tails if something bothers them.”

I don’t know what he and his girlfriend were doing to keep disturbing the rattlesnake, but to this day he is adamant that the snake was rattling its tail spontaneously.

Ab implanted the radio and everything seemed OK in Manaus, but soon after we released the snake it stopped moving and we found the radio in the partially eaten corpse. Some predator had killed it, but we don't know whether it was a natural death or the snake was suffering from the effects of the surgery. Ab left Manaus soon after and we did not continue the studies of the rattlesnakes. Still, the little we had learned indicated that they, like the arrow-head vipers, are much more common around people than we generally realize, and that the low number of bites reflects their complacent attitudes towards the people stumbling around them.