



Hunt Institute for Botanical Documentation
5th Floor, Hunt Library
Carnegie Mellon University
4909 Frew Street
Pittsburgh, PA 15213-3890
Telephone: 412-268-2434
Email: huntinst@andrew.cmu.edu
Web site: www.huntbotanical.org

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About the Institute

The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

On the Rio Negro above Manaus, Amazonas.

Actual traveling to and from places, especially distant ones, has no appeal for me, and whether where I am going is near or far, I am always glad to get there. Traveling for two days sitting on a backless bench in a C-47 took a lot out of me, and helping Pavan equip our expedition in Manaus took the rest, as anyone who has stood for only 10 minutes under a noonday equatorial sun can well imagine.

At 1 p.m. on Saturday, Sept. 29, with the sun directly overhead at the zenith, we cast off the ropes and the launch worked its way slowly out onto the broad expanse of the Rio Negro. Suddenly, almost miraculously, it was no longer hot. We threw off the senseless clothes of civilization, and as Manaus retreated slowly behind us and became only a small scar in the green, its scenes and smells a fading memory, everything seemed exhilarating, placid and delightful. And it has remained that way. There was (and almost always has been since) a brisk breeze blowing, which was raising small coffee-colored whitecaps. But we were, like the duck in "Peter and the Wolf", merely safe "in the middle of the pond" and it still seemed likely that, if we were put ashore, that exhausted "Manaus feeling" might come back again. Even this turned out to be wrong too, but I am getting ahead of the story.

There are lots of ways that the name of Chagas has been immortalized in Brazil; there are avenues, statues, laboratories, hospitals and public buildings which bear his name. This is as it should be, for it was Carlos Chagas who laid the cornerstone of the public health structure in Brazil, as well as elucidating the dreadful trypanosome disease which bears his name, too. What sort of an edifice rests on this auspicious foundation, especially in present-day Amazonas, is another, and rather disturbing story, and one that I would rather not write about. Among the least of Brazilian monuments to the name of Chagas are two motor launches belonging to the health department of the state of Amazonas. These are, respectively, "Carlos" and "Evandro Chagas", the latter being named after the brother of the famous parasitologist. "Evandro Chagas" has a 36 hp gasoline motor, which could do with a little medical attention itself, located in an engine room forward. As we chug at the rate of 4.5 mph against the almost negligible current of the Rio Negro, the motor is watched over with hawk-like constancy, by the "mestre", one Jose Peas da Silva, a casual, semi-philosophical, semi-poetical character of 60. Mestre, although very modest about most of his accomplishments in this life, frankly considers himself the "Number One in Amazonas in motors". When speaking in English, he is known to us as "Number One". He has a deeply lined and furrowed face but his hair, although sparse and soft, is incongruously dark in color, and he is very proud of this. At Number One's side languished the right-hand man, officially "piloto"; he is a young (about 20), blond lad, the nephew of Number One, Nilberto da Silva, otherwise known as Dede. Dede lacks upper incisors and badly needs a haircut.

Behind the engine room is a quite capacious main cabin, 10 x 6 feet, mais ou menos, with 4 windows on each side, 2 hard bunks with straw mattresses, a cabinet with drawers and a small table with a stool. Further aft is a narrow hallway which has a toilet-shower combination and a closet on one side and the galley on the other. During the entire day, from before dawn until way after dark, a small fanny in dirty white duck pants can be seen projecting from this cubicle. This belongs to our cook, Raymundo Matis Pereira, a very serious and hard-working fellow, whose general features are those of a Hindu. He has the small size, the delicate features and sensitive face, the long, wavy jet-black hair and dull skin typical of so many of the negroes of northern Brazil.

All the way stern there is a covered, porch-like affair, open on all sides and where there is a table with benches at the sides. A tin roof covers the whole and behind flaps the green, yellow and blue flag of Brazil.

All afternoon we wove slowly along the right bank of the Rio Negro. Our skipper had been informed that we were in no hurry to get anywhere, that we wanted to mosey our way for the next 5 days up to the mouth of the Rio Branco, staying as close to shore as he could keep us, and stopping whenever we felt like it or could smell some *Drosophila*. He took us very literally, and most of the time on this trip we have rarely been out of spitting distance of the jungle. Above Manaus, the river wind into whitecaps that the resemblance to a lake is inescapable again. The opposite shoreline, our view of it unobstructed at this point by islands, is a tiny strip of green above the black-blue water. The shore line we are following is alternately rocky and sandy, and there are many long, beautiful curving beaches, with little breakers rolling in over them. Above them stands, not the primeval jungle that we flew over in the plane, but second growth. Even in this remote place the saw and axe have taken their toll, and woodcutters must now travel 5 hours in any direction from Manaus before they can sink their axes into virgin timber. Although this may seem remarkable, it is true only for the water's edge, and back on the high bluffs, protected by relative inaccessibility, stands the original jungle. Nonetheless, even this second growth is very beautiful. Like Pirassumunga, it tends to go to palms and cecropia. Only here would it rate as poor, and it was only the second day, when I was gazing up in creepy wonder at the lush, balanced majesty of the primeval jungle, that I came to consider it so.

Toward evening, the river narrowed somewhat and acquired a current, as could be seen from the choppy waves that the wind made, blowing against it. The sun suddenly disappeared and it was dark. Number One nosed the launch into a shallow rocky cove and Dede lashed her to a tree projecting from a rocky ledge. It was an inky-black moonless night, but when the motor was cut off, everything was suddenly still, and I could feel the presence of the Jungle without seeing it. The night noises were modest, and mostly of insect origin. Thus my first excursion into an equatorial jungle was to be at night, because nothing, not even Frank Buck's leaping panthers or head-hunting Indians would have kept me in the boat that evening. Anyway, we had to lay the baits for the *Drosophila* we hoped to catch in the morning. Pavan and I laid the gangplank, which is really just a long narrow board, over to the rocky ledge, and clambered over it to the shore. We had easy going, as the ledge sloped down to a neat beach of white sand, which lay in the pocket of the little cove. Our reconitering expedition was brief, because Pavan's flashlight suddenly caught a pair of shining eyes, then two pairs and then three, across the cove from us. The eyes did not blink. At this second, only one thing was on Pavan's mind; he had vowed on the plane that we would taste the pleasures of jacare meat, and here it was—we could make out the form of a large alligator on the ledge of rock, connected to one of the pairs of eyes. I squatted on the beach in the dark, flailing at the mosquitoes, while Pavan rushed back to the boat for the gun. In form which was rarely displayed on later occasions, he put a bullet neatly through one of the eyes, while I held the flashlight. It was an amazing 30 yard shot. We dragged the jacare back to the boat, and dumped him on the deck. My guess would be he was 3 ft. long and weighed about 40 lbs.

After this, we settled down to business and lugged ashore our cans of fermenting fruit, 5-gallon lard tins, which we placed in under the jungle, after chopping away vegetation with the big faccos, so we would have room to swing the nets in the morning. This became routine on each of our overnight stops, so beating the bush at night is now a familiar game to me. For baiting (and occasional eating) purposes, we have quite a variety of fruits with us, most of which are fermenting like mad. In addition to the usual bananas, we have abacaxis (pineapple), grapefruit, caju and an evil smelling but *Drosophila* attractive tropical oddity known as genepapo, which looks like a soft bait, but I had a taste of this, which is the fruit of a tropical passion flower. We bought some from a toothless female vendor near the Manaus market. It is a sanitary one to eat, as you peel off a green skin, then a lightweight, spongy white pulp and eat the seedy center section. It is good, but like nothing else in the world. So, wherever we go, we allow the gentle perfume of these jungle juices to float on the night air. As I lay down on the bunk, the breeze had fallen to practically nothing, but just before I went to sleep, a little gust of air wafted the odor of the genepapo through the closed screens, and I was hoping the bocainensis, if it lived in Amazonas, would smell it too.

September 30: The first glimmer of light was accompanied by the muffled rattle of the coffee pot, and I am glad to report that, as northern coffee goes, Raymundo's is pretty good. While the Number One continued his struggles with oil leaks and the generator, the three of us collected the flies and then roamed around. The rocky ledges had been stripped of all large trees, and the second growth was an almost impenetrable mat of low shrubs and vines. Well, as I walked along the beaches my adventures were with little things, as they are 99% of the time for a naturalist. The sand was crisscrossed with the broad beaten trails of leaf-cutting ants, some active thoroughfares and some abandoned. Near them the sand was pockmarked with hundreds of little craters of ant lions, and as we goulishly (and who doesn't do this?) pushed ants into these craters and watched the lions shoot spurts of sand at them, I thought of my friend By, and the ant lions on the Big Piney.

As the electrical system of the launch was a gone goose, and with it the electric light and starting system, the motor got under way only after groanings and sweatings with the crank. The morning was cool and pleasant and a gentle delicious breeze was again favoring us. I climbed up on the roof of the launch and sat there on a wooden box and feasted my eyes on the shore. Slowly, gradually it changed and by mid-morning there was not an axe mark anywhere. From the brilliant white sand beaches, forming a sharp contrast with the dark water, the great jungle rises in an ever-varied pattern of colors, textures and shapes. The greens run the spectrum from blue to yellow, broken only rarely by flashes of bright color which are lianas or trees in flower. The crowns of the trees are packed in tight, and so woven together with vines that the whole is unbroken except where an occasional thatched hut stands, ringed by adults and children alike, standing stock still and staring out at us.

The river is obviously dropping rapidly. The Mestre says it falls at the rate of 3-5 inches a day, and where sand bars are being built up, the alder-like shrubs at the water's edge have brown at the base. Occasionally, some sign, like stranded driftwood (which seems to be scarce compared with our rivers at home) or a line on a tree, indicates the former, incredible height of water. Back from the water's edge, the river bank often rises to a considerable height and is apparently never flooded, forming a dry-floor forest. What we see at close hand, however, is the igapo, almost constantly. Joe, how I wish I could draw the forms of some of the trees and I wish even more that you were here to do it. Some are flat on top, some form pyramids and there are towslid rounded crowns of every description. Here and there are tremendous assymetrical giants, reaching way up out of the tangle of lianas and epiphytes and every type of trailing and twining plant, which bind and blend it all into one organic whole. Still, after 2 days, I look at it in a kind of awe, but perhaps I can see something before long--some correlations and meanings. It is so damn complicated.

Near noon, we entered an area of islands. Here the river is incredibly broad, about 20 miles, and it breaks up and flows among these long, large islands in relatively narrow and sometimes perceptibly swift, channels. As we wind through these channels, the river seems cozier and friendlier, with the jungle close by on both sides. There is little more sand and rocks; the islands here have a base of yellow-brown alluvial clay and are low, being undoubtedly deeply flooded at times of high water. Now they project neatly up out of the black water, clothed almost to the water-line.

Just before lunchtime, Antonio sighted through the field glasses what he thought were maracuja fruits, and Number One was prevailed upon to stop and nose the Chagas into a clean sand beach, above which was a tiny group of thatched huts. As we jumped off, we were greeted by handshakes and small talk, which was finally guided around to the subject of fruits on the forest floor. Antonio was wrong about the maracuja, but one fellow said he knew where there were some rotting cajui fruits and offered to take us there. Clad in our store clothes, shirt, bluejeans and boots, and laden with collecting nets and vials, we followed his lithe figure through the woods. The spot was superb; in a few minutes we had all we could possibly identify in an afternoon.

The little crowd of well-wishers gathered on the beach as we prepared to embark; they were a robust healthy-looking lot, with genes predominantly of African origin, only partially diluted by Indian and a smattering of white. Probably to a man, though, they all carried Plasmodium in their bloods, because malaria is very common all up and down the river. There is no denying

that to come here is to run the risk of infection, and our method of avoiding it consists of stopping for the night far from human habitation so that we will be less likely to be bitten by infected mosquitoes. The drug we take, twice a week, (chloroquinida) is an effective supres-sant, but there is no known way to prevent the actual infection. We exchanged mutual gifts; they gave us sugar cans and we gave them cigarettes, all but the tail of the alligator and a pop bottle full of motor oil. I took their picture we we pulled out; they made a lovely infomal group, with the children splashing and playing in the water, and the old lady, with her hat askew, smoking her pipe. But the instant they spied the camra they formed a quick, stiff, formal group, as if by magic, standing very straight, very still and very solemn.

Raymundo put before us one of his hash-like creations for lunch. These consist as far as I can figure out, of a basis of jerked meat or dried fish, potatoes, onions, yellow coloring matter and the whole well lubricated with olive oil. In addition to boiled beans and rice, which is always served, there was the alligator, a white, somewhat fibery but not tough meat, without fishy flavor, and with a pleasant, although non-committal taste.

Wires got crossed somewhere and we brought no farinha with us. Altho I was quite nonchalant about this, the Mestre and Dede were horrified, for to them a meal not liberally dusted with this mandioca farinha of the north, "farinha da agua", is no meal at all and for several days they were starving amid plenty. We did get hold of some later, though, and it was really something to see Dede prepare his meal. First, boiled beans, enough to cover the entire plate, than a huge mound of rice, followed by stew, hash, spagetti or macroni or anything else that happens to be around. Finally comes the farinha da agua, which is heaped on top until the plate looks like a mountain of river gravel. He then homogenates the whole with knife and fork and begins stoking himself.

It would be hard to underestimate the importance of a staple food like mandioca; almost alone it supports the lives of 95% or more of the people living in tropical Brazil. When I heard how it is prepared, I found it hard to believe that any nutritive value could be left. The roots are dug, washed and then put in a big jug or kettle and allowed to soak in water for several days. They sort of rot during this period and give up a sort of gluten. After this, what is left of the roots is dried and finally pounded up to form a coarse, pebbly and very hard white stuff. This is used dry, as I indicated. Now how in the devil could there be any nutritive value left? Later, George Addison, of the Instituto Agronomico de Norte answered this for me. Analyses of farinha da agua show it to be a highly nutritious food, loaded to the gills with B vitamins and all the rest. The reason is simple. The period of soaking is a period of fermentation, and yeasts are always present and grow rapidly on the carbohydrates freed by the soaking. When the mandioca is dried, quantities of yeast are dried along with it. He agreed with me heartily that it is often dangerous to try to "improve" the time-tested, and often apparently primitive, ways of preparing foods. In this case, any attempt to be sanitary in the preparation of farinha would greatly reduce its nutritive value.

Preconceptions of what this experience would be like are slowly fading away. Despite the fact that I know, as most people know, that the jungle of Frank Buck and other cinematic nature-fakers is grossly inaccurate, I had still somehow thought it would be different than it is. The jungles of the Rio Negro are quiet, placid and inviting and far safer than any city street. There are neither snakes hanging from every tree (outside of a zoo I have not seen a snake in Brazil, damn it, despite the fact that I am looking hard much of the time), nor are jaguars, black or otherwise, anywhere around where they can be seen. Alligators, capybaras and agouti are nocturnal, and we would be very lucky if we see any one during the day. There are not brilliant tropical birds on every hand. Despite the fact that I was somewhat prepared for this, I had expected to see more than we are seeing.

Moving pictures, no matter how honestly made, can never portray wildlife as the casual eye sees it. The "uninteresting" parts are clipped out, and what is retained in a movie, or what is written in many books, for that matter, is far from the true picture. I think we do not realize how much the gorgeous pictures, such as are given on Audubon Society screen tour lectures, mislead people. They think that all you have to do is to go to some special region and that you

will see all these things in their glory, as easily as the camera seems to do. "Beaver Valley" does not give any inkling of the hours of toil and planning that goes into the building of blinds, and the hours and hours of waiting looking at nothing in front of the camera, or the shots that failed because it was clouding up for a rain. They do not give any idea of the usual why in which one sees things like birds, for instance. My present idea of a toucan, for example, has been constructed from fleeting glimpses, now of tail, now of beak, now of back, and not under conditions favorable for kodachromes, either.

Hour after hour, we move along close to this intense, overpowering vegetation, which is true. But flowers are only here and there, and they draw the eye away from the seemingly endless greens. Nor are the flowers under any obligation to be spectacular and form a mass effect; such are, in fact, scarce, although individually, when held in the hand, flowers or flower clusters are often exquisitely beautiful. Three species of liana seem to be providing the spectacles at the moment. There is a rarish scarlet one, a flashing yellow and occasionally a beauty which has cascades of purple and white pea-like legume flowers. These are grand, of course, but have you ever been on an Ozark hillside in May? Birds are rare enough, as seen from the boat, that is, to make it worthwhile for some one to point them out, and this is especially true in the middle of the day. There seem to be no concentrations of birds, such as one would find on our Gulf Coast in winter-time. This is, of course, the beginning of spring here, and migratory birds may have already left for the summer in Argentina. Now, if this sounds dull, let me hasten to assure you it isn't. When you do see a toucan, a parrot or a hairy eagle, believe me, they are worth waiting for.

To a North American, a change of season means before all else a change in temperature, but to the biota of a region, seasonal changes consist of a constellation of things, of which temperature is only one. Here, the temperature does not change from one month to the next, yet on every hand there are evidences of vast cyclic changes. The leader in this, of course, is the water level cycle of the river itself. Six months it is down and the marginal forest is dry, or relatively so; six months it is up, and the forest is deeply flooded in water. Here is a seasonal change of the most far-reaching magnitude, and the adaptations of the jungle to this never cease to amaze and interest me. A case in point, which we know a little bit about, is the fruit situation. Right now, the floor of the igapo forest is dry and search as we may, even with the help of natives, we can find practically no naturally rotting wild fruits. This is quite the reverse of the situation which Dobzhansky and Pavan found here in March of 1949, when no inquiries were even necessary, as fruits could be found abundantly and easily. Conversely, this now appears to be the beginning of the flowering season; many trees are in flower and some are budding. This is, of course, only statistically true; there is no barrier to the dropping of fruits at this season by a tree if it is biologically useful for it to do so.

I feel that I could only begin to understand this place if it were possible to make this same trip 12 times a year, once a month, and this would only provide a skeleton of information. It would be just as absurd, to judge the biota here on the basis of the present 9 days, as it would to judge the Missouri forest during a 10-day float on the Meramec during early October.

We pushed in under a high clay bank for the night. The Mestre said it was an island in the river, but this is hard to tell; we had been following the shore for several hours without finding a break in it. The igapo towered above us, and as we sat in the stillness eating supper, I could hear the porpoises breaking water, way out in the channel. They are big fellows, called botos, and we often run into large schools of them. They surface loudly, with a grunting exhalation of air, and never seem to come up alone, but always in pairs, with the second one so close behind the first that it seems like a single motion. We could also hear the 4, 5, or 6 hollow hoot-like sound that a little tree rat makes. Number One claims it is a very small animal and that the loudness of its voice stems from the fact that he hoots inside a hollow log. All was calm, cool and peaceful; there were no mosquitoes and the Mestre was feeling dreamy and philosophical. He was looking out over the black water. "O Rio Negro e muito bonito, muito bonito" he murmured to no one in particular. I agreed with him.

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October 1, 1951

This business of catching flies is wonderful! You see, it takes a couple of people only about 10 minutes to go over the baits, or iscas, and then you have to rest things for a while; there is usually not much point in collecting before another half hour or so. I use these intervals for sitting on a convenient log and looking things over in general. This, I am sure, will please Edgar Anderson, who has long championed the sit method, although he insists that you must be really lazy, not think about anything and not get up for a half an hour. It is reported that he used to make Ralph Erickson sit among the Clematis this way and Erickson was pretty highly critical of the whole business, considering it a waste of time and a lot of nonsense and so forth, and was one day promulgating this point of view vociferously. Then, after a pause, he said, changing the subject: "Say, you know while I was sitting there, I noticed....."

It was on this morning that I sat in a more or less natural armchair formed by the wing-like roots of big igapo trees, which commanded a pretty good view of several other large trees, the idea being that I might get a better look at a toucan, which I have learned to identify mostly by creaking noises. I saw nothing. I didn't even notice anything and I have no comments, ecological or otherwise, except that one of these big Morpho butterflies with the incredible blue wings floated by through the trees and that everything was nice as hell. This may sound idyllic, and it was, but after this I sat only on logs, because I got the nicest crop of chiggers from that armchair that I have had since the family blackberry outing last year.

This morning I spent a lot of time up on top of the boat, looking up at the jungle. It was a coolish, cloudy-bright day, with a faint intermittent breeze. To my left, the Rio Negro was smooth and placid, with just a faint ground smell. I found myself looking at the forms of the trees again, not with any scientific eye, but just feasting on the vine-muffled variety of shapes. The general form of the trees is best seen from a distance, not close to shore, and on the opposite side of this rather narrow channel, the morning light accentuates the endless folds, creases, verticals and horizontals that make up this curtain of vegetation. "Vegetation" is really a poor word to use, it gives the connotation of some sort of undifferentiated green sludge, instead of the complex and biologically meaningful panorama of the interrelated protoplasm that it really is. In this connection, I can't resist passing on the remark of a mahogany purchaser from Philadelphia who sat next to me as we flew back from Manaus to Belem. He was talking my ear off in his shrill voice with the Central High School accent, all about the Army football scandal, the present price of shoes in Philadelphia, and I don't know what all. After about an hour and a half he ran down, and sat looking down out of the window at the jungle. I knew he wouldn't be quiet long, and he wasn't. "Gee," he said, "there's a lot of vegetation down there."

Occasionally the launch would pass close to a deep-water island, with no dry land at all, and the jungle would be reduced to only shrubby water-growing stuff which, nonetheless, is strikingly set off by clusters of joari palms, like a multiple group of featherdusters, sticking out above the rest.

I suppose it was about noon (my watch ran down the first day, and I have given it a good rest since) when we came to a ruthlessly slashed and burnt clearing in the jungle, with a desolate little thatched hut sitting in the middle of it, scorching in the sun. A man on shore gesticulated towards us and held something up, so we circled around and nosed into the shore. It was the usual type of homestead operation, with a couple of banana trees and some mandioca plants growing among the ugly charred stumps and felled logs. A pile of wash, lying on the seat of a small wooden boat was covered with butterflies, red, yellow and orange. Somewhere I have heard what attracts them like this, but I have forgotten what it is. The man held the hind quarters of a paca, a big tailless rodent which is common all over Brazil. For 10 cruzeiros it was ours, as well as some very interesting fish, obviously caught only that morning. One was a carnivorous beast with long jagged teeth (it was not a piranha), and another, called arauana, which had two peculiar long soft feelers on the lower jaw, great big eyes and a bowfin-like tail. The latter was one of the tastiest fish I have ever eaten, very akin to chicken.

After we started on, I climbed back up on the roof at the risk of burning my already red body to a crisp in order to try to get some pictures of the jungle, because we were passing some exceptionally fine "heads" of jungle. Despite the fact that I knew that the proportions will be hard to get, I took quite a few without any person in them, and was therefore overjoyed to spy a couple of men in a small river boat ahead of us. As we slowly overhauled them, I got the Mestre to steer over close to them so I could use them as foreground. There was a valuable exchange of Portuguese, and before I knew it we had tied them on behind and thus acquired our first hitch-hikers. It seems that these fellows had left Manaus some 6 hours before we had and had been paddling home upriver, with scarcely any rest, for two solid days. They had another day to go at their pace, and about 6 hours at ours.

The wood boats that the native people use here are about 12 to 15 feet long, sharply pointed at both ends and are cleverly made. They are much lighter than Missouri John boats and lighter and more maneuverable than the French-Canadian bateaux. They ride very low in the water and are tippy as the devil. The people use short paddles with very broad blades, sometimes very fancily decorated and painted, but the ones these fellows had were plain. The back of the boat, as usual, was covered by a low, thatched dome, under which their supplies were protected from the sun. A single person always paddles one of these boats from the bow, with his stern, or rather, that of the boat, sticking up out of the water. This seemed peculiar to me, because in a canoe you just go around in circles if you try this.

The strong bowman in this crew was, I suppose, a negro; I find it very difficult to diagnose many of these fellows. All are phenotypically very dark from years of exposure to the sun and, as I have pointed out before, the features of the northern negroes are delicate. Like Dede, he had only canine teeth in his upper jaw, a fact which made his smile a rather ghoulish business. The other fellow was an old man, with obviously no negro or Indian genes, who had a bristly beard, a hook nose and horn-rim glasses, which could barely be seen under his old battered straw hat.

These fellows, as seems to be usual on the river, had something to offer, too. First, there was a tin plateful of farinha da agua (which Dede ate almost singlehanded) and secondly, a real treasure--a hatful of turtle eggs, which had been dug from the sand of a beach the night before. Now, at first I was not very impressed, although it was made very clear to me that these were none other than the eggs of the tracaga, and considered far and away the greatest delicacy that the river had to offer. This was probably because I watched Raymundo prepare them for our desert. He broke each egg into a shallow dish. The yold is a very glutinous orange goo, like heavy corn syrup or perhaps even more like soft taffy. To this he added sugar, and placed this calmly in front of me, in its primitive raw state, with a gesture which triumphantly said "Now, try that." I gagged a little but knew I must, so I picked up the spoon and wound some of the stuff onto it. Like the guy in the beer ad, I was convinced by the first taste. It was the most goddam delicious stuff I had ever tasted! In fact, this first encounter with tracaja eggs was enough to cause us to stop later at more than one sand beach and try out luck at finding them.

Towing these fellows was not without design, because we hoped that they might return the favor by showing us fruits in the forest where we might collect flies. We figured that we would reach their home before dark, collect and then move on for the night. We especially did not want to accept their invitation of a night's anchorage, because the younger one had casually remarked that he had had a crisis of malaria only ten days before. There is no doubt that this was true, but as he squatted in the sun on the rear of the launch, smoking a very neat and white Sao Paulo cigarette that I gave him, he was the perfect picture of robust muscular aboriginal health. I could see those gametocytes going around and around and around, in my mind's eye.

The sun was quite low over the water as we finally rounded a point, crossed a big open bay-like affair on which terns were diving and calling and headed for a tiny clearing at the top of a steep high clay bank. The rest of the "family" was waiting on the bank; this consisted of three boys, between about 12 and 16, robust and broadshouldered and who had unmistakable Indian features, with long black hair. What the relationships among this motley crew were I never found out, but it was clear that they all lived together in a thatched, open shack on poles, and

without any females cluttering up the place. The establishment was obviously primarily maintained by hunting and fishing, because there were a half dozen or so neatly made and efficient-looking harpoons, one type for smaller fish, with a dagger-like wooden point and another for larger stuff, with a regular barbed steel point, attached to heavy cord. There were, of course, a few bananas, mandiocas and chickens and a couple of very suspicious dogs. The 'house' was merely a shelter built of poles, with a pole floor raised about five feet above the ground and with a short stout ladder leading up to it. It was roofed with palm thatch and was devoid of walls and furniture, except for the hammocks, which were hung to the rafters, and a few tin cans here and there. The clearing in which this sat was small, and the vast jungle trees soared above it, their height seeming to be grossly exaggerated. There was a turtle stockade of poles, too, and paddles, that is, if the sawing ever got finished.

There were no fruits, so we shook hands all around and prepared to leave, although it was almost dark. I breathed a sigh of relief as we started to back out, my mind being on those gametocytes. Suddenly with a glurr, the Chagas' motor died, and, the Mestre being what he is, and the motor being what it is, we were there for the night, whether we liked it or not. So we had supper there under the airless clay bank while the Indian boys came down and had their evening swim, splashing and playing in the water in the pitch darkness. And then I realized that there were no mosquitoes after all. We lugged the heavy cans of fruit up the clay bank and carried them back into the jungle, and I can still see the shadowy form of Pavan in the peculiar light of the flashlight, slashing and hacking at lianas with his facao.

It was late and back at the launch again, Antonio and I turned in, while Pavan went off with the negro fellow to hunt alligators. I realize now that I missed something by not going; I had visualized this as a shooting hunt and wasn't too keen on it. It seems, though, that Pavan was treated to a wonderful show of native skill, for not only did his fellow harpoon three alligators, but, on one occasion, leapt out of the boat like a cat and pounced on a huge tracaaja which had come out on a small beach to lay its eggs. The next day we not only had turtle stew and alligator steak but we also had the eggs for dessert, which that particular tracaaja never got a chance to lay.

October 2: I had an especially long and delightful sit in the forest this morning, because Pavan went off hunting again with his native friend. One striking feature of these igapo forests that is slowly sinking in is the staggering variety of legumes, many of which are giant trees. My guess on this is that probably this alluvial soil is so depleted of soluble nitrates that nitrogen-fixation has from time immemorial had a high adaptive value. Furthermore, the pods on most of them are unbelievable. The general feature is very great size, especially of the seed itself. This is so emphasized in some cases that the pod of one species of tree contains only one seed, a tremendous bean affair, the size of your fist, only long-oval in shape. I get great pleasure from cracking open these and slicing up the great big bilaterally symmetrical cotyledons. I smell an adaptation, here; the biological meaning of this is clear. A large seed stores a large amount of nutriment of the seed, from which the seedling grows like from the halves of some huge clam. Millions of these seeds sprout only to die, and dead seedlings of approximately this height are on every hand.

There are few plants which can grow on the forest floor under the trees of the igapo, and everywhere it is very easy to walk through it. There are trees of all sizes, of course, but small ones are generally found only where a big one has fallen or been cut down. It seems to me that this can't be the lack of light, because at Vila Atlantica there is layer upon layer of vegetation. I think it must be the exigencies of an environment which is under water for 6 months. This forest would puzzle Mother, too, Joe, because there aren't lots of little annual flowers and stuff. It is a real he-man forest, a forest of trees and no monkey business. Some of the lianas are legumes too, though, and have very beautiful flowers.

Well, I had some minor little adventures, such as watching a little green and gold lizard catch insects almost at my feet, but nothing dramatic--still the toucans and the monkeys elude me. But that toucans were around though was proved by Pavan who shot two gorgeous male birds that I

later made skins of. The colors in this species are something. The bill, of course, is large and long, but very light in weight. It is purplish blue edged with yellow and has blue and black at the base. The throat and breast are clear canary yellow, edged with red, and stand out brilliantly against the jet-black body and wings. The undertail coverts are fiery red. Such color seems a caprice of nature, but then, is anybody in the audience a specialist on the love life of the toucan? Toucans, I guess are palm birds; the ones we skinned contained palm fruits in the crop, each about the size of a walnut. But why this big bill business? The palm fruit fits in the bill all right and roll nicely down a couple of grooves, but surely nature could have worked up a better device than this. Has the bill of the toucan, with its color and all that, gotten fouled up in courtship display or something like that? If so, tampering with ingestion apparatus is a rather dangerous type of sexual selection. Well, I will have to go look in a book or else study the home life of the toucans myself.

We got a late start this morning and the time lurch was over it had begun to cloud up and before long we were hit by a terrific gale of wind and a series of heavy showers, and the Chagas pitched and rolled in the waves. We are over on the north side of the river, and the water is not so dark as it is on the other side; the whitecaps are now weak tea, no longer coffee. This is the influence already of the Rio Branco, still twenty or thirty miles upstream. We did not stop, but kept going, close to shore. It was a wild scene, with the big waves rolling in from the opposite shore, which was only occasionally visible through the fog and rain. It gave the feeling when you looked in that direction, of being just off the seacoast, looking out to sea, rather than of being, as we were 1200 miles inland.

The storm went as suddenly as it came, but still the waves dashed against the clay bank of the island we were following, lightening the color of the water at the edge to a muddy brown. Through the binoculars we could make out a beach on the far shore. We headed for it, as we had not yet spent a night at a real beach, and then, too, visions of tracaja eggs were dancing in our heads.

As we neared the beach, the wind died and the sunset suddenly flared crimson across the water. Before us lay the greenest paradise I have yet seen in this jungle, which is theoretically the green hell. The tremendous wall of the jungle rose from a gently sloping clear open beach of white sand, interrupted here and there by giant trees which had fallen across it. The Mestre cut the motor, and we drifted in to tie to a fallen tree which stretched from the jungle all the way across the beach and 30 feet or more out into deep water. I sprang off the boat onto the beach and stood, trying to capture the moment,--the soft, clear evening light and the mingling of dripping jungle and chattering parrots. This, of course, would be the moment for Dorothy Lamour to come out on the beach in a sarong and thank God she didn't because this was real and she might have spoiled it.

After supper, in the open "back porch" of the launch, we went for a walk on the beach, after setting the bait cans inside the edge of the forest. For the second straight night we had hit a place without mosquitoes. It was cool and pleasant, with a gentle breeze raising little waves which lapped on the sand. Theoretically this was a tracaja hunt, but we saw no tracajas, nor was any of us really disappointed by this. It was enough just to drink in the deliciousness of this place.

October 3: The clearing evening last night was deceptive, because during the night we were lashed by heavy tropical rains and the morning was overcast and still. Dark streaks of humus had washed out of the forest here and there across the sand. This is quite an interesting beach. The river has obviously been cutting into the jungle here, resulting in the giant fallen trees, complete with their lianas, which extend out over the beach. None of the falls is recent, however, they are black, wet from the rain and many of them are dotted with small brown fungi. If you dig down into the sand, you find that the clay lies close underneath it and the sand does not extend beyond 100 yards or so back into the jungle. I suppose this means that the cutting has stopped and that the river is now building the beach there. In underneath the trees it was eerie and dark, with the white sand underfoot pockmarked by the drips from the trees.

I had planned a series of find photographs, but got no cooperation from the weather and all of this will have to remain a visual memory. Before leaving, we swam in the warm, black water. Tiny fish nibbled at my feet, and I can't say I wasn't thinking about the piranhas, the savage small fish with big teeth which is supposed to tear you up. All the natives seem to swim a lot, though, and as these fish are local, and travel in schools, I suspect a piranha attack is a relatively rare occurrence. There seems to be no danger if one is able to get out in a hurry if necessary. Somehow I had thought that they were so common that one dare not even stick a toe in the water anywhere. And as a population geneticist, too!

We are moving on upstream. The islands are fewer now, and the river has become very broad, but I still doubt whether we can see the main shore. In the middle of the morning, however, it was clear that we were following up the true left bank of the river. Rocky ledges had appeared again and occasionally rocky bluffs rising up to high ridges that under no circumstances could be covered with water at flood time. On these ridges, the jungle is incredibly awesome, because one gets the illusion, occasionally, that the bank is really low and flat and that the vegetation rises in tiers, so that the trees behind seem to be supercolossal in height.

Again, the day was cloudy-bright and although we were already pretty burned by the sun, everyone's color brightened again. These rocky uplands assure safety from high water, and we passed occasional small clearings with houses, one of which even had a tin roof and matting walls. At one time, we were obviously near a village, but we didn't see it. The giveaway was a small cloud of circling Black Vultures, which are almost never seen away from human habitation in this country. Above the rocks, worn smooth by eons of floods, I spotted a little cemetery, just a hole in the jungle with flimsy weatherbeaten wooden crosses, helter-skelter at crazy angles. What put each of these lost souls in his grave? I doubt if anybody knows, but this knowledge would be fundamental, I should think, to the future development of this unconquered land.

I have been riding on the roof most the morning and when the breeze drops and the sun is out the heat has an overpowering, stifling weight. At such moments, I realize that I have been drawing perhaps too ideal a picture of the climate here, but even in these moments, and consequently, there is no choking humidity, which I had expected. Never on the river have I felt anything like what I experienced walking the streets of Manaus. Concrete intensifies the heat, whereas the jungle softens it. People seem to feel that before you can have a civilization, you must have a city. In the tropics, a city may be defined as an area of earth surface closely resembling a flaming inferno, denuded of the flora which holds back the sun, and into which the human population selectively gathers, surrounding itself with the most heat-absorbent materials imaginable, as well as the conditions most favorable for disease. If man would try to live with nature, instead of fighting it, in blind frontal attack, I see every reason for success, but if he continues to try to use the methods of taming the land which have proved successful in temperate climates, I can only see continuing failure.

Along this same line, I have heard that some authorities, such as Prof. Harland, for example, have dismissed as a myth the general impression that the soils of the Amazon basin are rich, deep and fertile. He maintains, as I understand it, that almost any crop does poorly when the jungle is cleared. This is probably true all right, but I think the idea conveys an erroneous impression. The whole idea of a "crop", in the sense of so many acres of corn, rice or beans is one that is utterly foreign to the tropics, where the biota is naturally so diverse. Furthermore, who knows what may be grown here? Most of the failures seem to be due to a gross misunderstanding of the biological problems. Temperate plants just will not grow well in the tropics, and the cleared-land single-crop system will have to some day be replaced by a more realistic and biologically natural agricultural system. It is, for instance, fully conceivable that the whole idea of clearing land constitutes a mistake here and a mental impediment to progressive thinking along this line. Soil that supports vegetation such as I have been seeing along the Rio Negro, although it may be leached and alluvial, just can't be "poor" in any general sense. And what plants to use? Maybe we have to start all over again and domesticate useful plants right out of the jungle.

Most clearings that I have mentioned are usually less than an acre, but in the middle of the afternoon we rounded a high rocky point and saw Ayrao in front of us. This is the first real village which we have seen since leaving Mansus, 5 days ago. Ayrao has about 40 cleared acres and I would guess that somewhat less than 100 people live here making their living by gathering brazilnuts and rubber on a huge tract of jungle owned by a Sr. Francisco de Vasconcelos, who lives in a strangely Victorian house, complete with glass windows. Below this house, which is set right up on a high place surrounded by fruit trees, live the people who work for him, in a row of joined stucco houses, mouldering and stinking, and set right in the blazing open sun. This latter business never fails to amaze me. Why doesn't somebody try to integrate his dwelling into the forest? There was only one house on the whole river that I saw that was set in the kind of place that I would mine. It was an Indian establishment, and just enough trees sheltered it to give it charm and comfort.

Pavan went ashore to see if he could buy oil and farinha, and I tagged along, camera slung over my shoulder. There was considerable grass growing here, I suppose an indication of a clearing of long standing, and it is being kept closely cropped by about 30 head of Brahamans, most of which were thin and scraggly. No fences kept the cattle from wandering along the squalid row of houses and the filth and smell, mixing with odors peculiarly human, was awful. We leaned against one of the houses and exchanged amenities with the only one of 15 or so people who had anything to say. The rest, strange mixtures of white, Indian and negro, with an occasional blond head here and there, stood looking at us in the frank, intense way that people do who rarely see strangers.

We shortly went to the storehouse, the end one in the row, and inside the musty place there were hanging from the ceiling dried skins, which I suppose were for sale or trade. There was "onca" (the jaguar; really a tremendous tiger) and "puma", indistinguishable, to a casual glance, from our western ones and jaguatirica, a small spotted leopard-like affair, capivara (which has a b for a v, in English) and finally what was to me the most astonishing of all, the skin of a "lontra". The latter is an otter of very great size; the skin was over 8 feet in length without the tail. On a trip like this, of course, we would be very lucky if we were to see any one of these large mammals or any one of those not represented in the Ayrao storehouse, peccary, sloths or manatees. The biggest mammal I have seen, aside from the botas or propoises which are abundant in the river, is a medium-sized brown monkey. I have seen these twice, from the top of the boat, but only as they swing through the trees, and they disappear so fast that it is difficult to get the field glasses on them fast enough to see anything. A wild monkey is about as tame as the proverbial hoot-owl. I was glad to get out of Ayrao; there were too many eyes full of misery, too much hopelessness and apathy. There were few smiles and few genial handshakes in Ayrao, and I felt strangely uncomfortable and out of place. I kept the camera where it was; somehow I am not cut out for taking photograph of unfortunate people so that fortunate people like myself can go "tak-tak" over them in a comfortable living room.

Back on the launch, with Ayrao growing smaller behind us, we held a council of war. Up to now we had no schedule and had just been poking along as we felt like it. If, however, we were going to make connections for our return trip to Sao Paulo, we would have to get to Moura and the mouth of the Rio Branco tomorrow. So we decided to lay some baits near Ayrao that evening, to be collected from on our way back a day or so later, and then push on in the dark until about 10 o'clock that night. This worked out perfectly; we selected a spot, put out the cans and then slipped back out onto the smooth peaceful surface of the Rio Negro just as the sun was disappearing behind the jungle of the opposite shore. I'm not going to try to describe the sunset because even the best kodachromes couldn't possibly do that. Suffice it to say that there was a new moon, an evening star and artistically placed clouds; the jungle was upside down, too, in the glasslike Rio, and there were green parrots over the black water.