

# THE JUNGLES OF PANAMA

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THE more I thought about it, the more it seemed to me important that my boy should, before his habits of thought and life had become conventionalized, feel the grip of one of the most tremendous of all experiences, that of being all alone in a tropical jungle.

I remembered how my own experiences in the forests of Java had formed a sort of background to all the later experiences of my life and had given me a different outlook upon the world. In the years since then there has been a perpetual longing to return, a longing full of bright sunshine, shady forest scenes, singing birds, strange insect lives, and the mystery of the moonlight through the palms.

Panama somehow had not occurred to me, even though in 1898 I had crossed the Isthmus. It had become, to my mind, a canal, a place of hospital buildings, locks, sanitary inspectors, and fortifications. The tourists who came back from there told nothing of the jungle; they either had not seen any or were not impressed by it. The tourist to Miami talked more about the tropical hammock than the tourist to Panama about the jungle.

But the fact that there was no malaria in the Canal Zone and that we could live there as safely as at home finally riveted our attention upon Panama and we began to analyze its possibilities.

## ARRIVAL AT THE JUNGLE

It was summer, midsummer, and one friend wrote: "Why do you think of going to Panama in the hurricane season and the rainy season; it's the worst time to go." Another questioned whether there were any butterflies or any flowers to be seen in the rainy season. But we talked to the men who knew about these things and made up our minds that Panama was the place to visit, and after we left Norfolk every interview on board and every knot the steamer made nearer to the Canal convinced us that we had made no mistake.

To drop your office papers on Wednesday, land at a tropical waterfront a week from the following day, and be chasing butterflies in a gorgeous tropical jungle on Friday was the experience which surpassed anything we had imagined possible. We had had barely time to change our clothes, as it were, before we were actually in that far-away, mysterious place which most people think of as so remote that they can never hope to go there. It was a foretaste of those swift changes of environment which will soon be the common experience of the race when the highway overhead is really opened.

The cool morning ride to Gamboa, past yam patches and cassava fields, with their background of palms and tangled forests, every plant dripping and green, was the first thrill. Then came an eight-mile launch ride up the Chagres to Juan Mina, with superb green hillsides covered with that incomparable mixture of forest trees loaded with hanging vines which is associated only with a heavy rainfall near the Equator.

## AS IN A WORLD BEFORE THE ADVENT OF MAN

"Me for the tropics!" was the boy's exclamation, and so swiftly did he disappear up the jungle trail that it was not until two hours later, when he failed to show up, that I realized that I was not quite sure he might not stray too far from the trail itself and be lost in a forest which stretches away for hundreds of miles toward Costa Rica.

It is a gripping experience and a bit frightening suddenly to find, not houses and lamp-posts and the noisy people who have composed the customary environment and whom one understands, but in every direction and everywhere strange, silent tree trunks, no two alike.

I felt as though I were in the world as it was before man existed. I was where life teems and new forms develop, in the midst of that living stuff up out of which



Photograph by H. Wimmer

A JUNGLE ROAD IN PANAMA

Rank, weedy vegetation and a general unkempt appearance characterize the fringe of the jungle such as that along this primitive road. The plants swarm with insect and fungus parasites, and lianas hang like ropes from the tops of the trees. It is much like a wood road in our South in midsummer.



Photographs by H. G. Cornthwaite

#### IN THE TREETOPS OF THE JUNGLES OF PANAMA

At the left are nests of weaver-birds, which resemble the oriole nests of the north, hanging in clusters on a tree in Gatun Lake. Often they are built side by side with the nests of wasps and bees, and the stinging insects are said to protect the birds, from reptiles. In the center is an old termite (white ant) nest with a strangler fig vine growing over it. Such dark-brown nests swarm with soldiers and workers which have squirt-guns in their heads; when disturbed they eject a fluid whose unpleasant odor is obnoxious to their enemies. These are not mushroom-growing ants. At the right is a large cuipo tree (see page 134) in the dry season. In the branches are the hanging nests of weaver-birds.



Photograph by H. Pittier

## THE STATELY CUIPO TREE OF PANAMA

It is a shock to learn that this stately forest monarch, *Cavanillesia platanifolia*, which is one of the striking features of the Panama landscape, is worthless as a timber tree, having wood too soft and spongy to be of any value—at least no use has yet been found for it.

man came ages ago—alone among millions of living, silent creatures. It is one thing to be alone in the desert or at sea and quite another to be alone in the jungle, buried in the very bosom of that great something out of which all life has come.

The world of human beings ceased to be what it had been to me and became merely a fringe of the great life of the world. Things are happening here in this great silent reservoir of life, and these are just as important as those which take place on city streets.

Looking up, we saw the feathery leaves and flowers of the tall, gray-trunked trees or the drooping leaflets of tall, slender palms, or creepers of every imaginable form.

Looking down, there were seedlings everywhere—palm seedlings, hundreds of them, coming up from where a bunch of the palm fruit fell and rotted. Ferns of beautiful strange forms and selaginellas cover the fallen trunks and palm stems.

We could not tread a single step off the trail without stepping on some tender little seedling which was as confidently raising its head in the deep shade and constant moisture of the forest floor as if it were on a greenhouse bench.

#### DEATH AND DESTRUCTION STALK IN THE JUNGLE

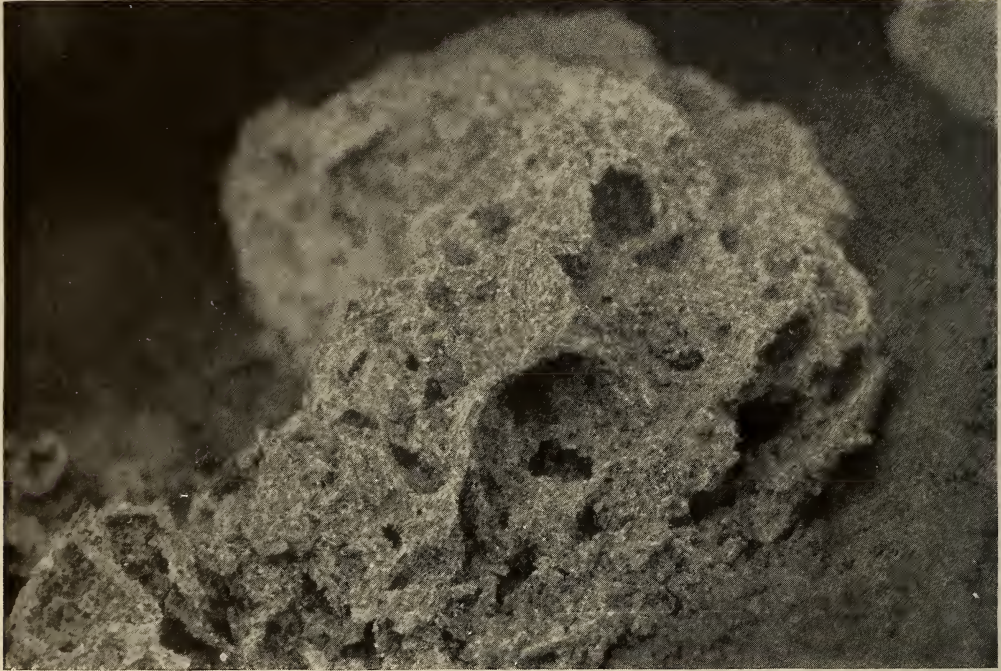
You may imagine that the plants in a jungle are healthy. Far from it! A look around will soon show that there is hardly a leaf in sight which has not some insect-made hole through it. I stood still just off the trail and picked all the leaves within my reach, until I had a handful. Some were so riddled with holes that they looked like lacework; others so tunneled by leaf miners that they looked like gray-green puffed-up bags. Some were spotted with fungus leaf spots;



Photograph by H. G. Cornthwaite

#### THE STRANGLER FICUS AND ITS VICTIM: PANAMA

From a tiny seed dropped by some bird in the branches of this giant forest tree, there grew a little "rubber" plant, which dropped in time a thread-like rootlet to the ground. This rootlet grew and thickened to a trunk and sent out other rootlets by the dozens, until they quite inclosed the forest tree itself, and some day they will choke it.



Photograph by David Fairchild

#### THE MUSHROOM SPAWN OF A LEAF-CUTTING ANT: PANAMA

On the floor of a miniature cave is piled this gray mushroom spawn, kept perpetually growing by the leaf fragments brought to it by the *atta* ants. Everywhere, scattered over the spawn, are the clusters of glistening white mushrooms which form the food of the baby *attas* (see text, page 139).

others covered with lichens and parasitic algæ.

It was hard to understand why, with all of these diseases rampant, the place should look, not like a plant hospital, but more like a nursery of plants which were all being given the best conditions for growth. There would appear to be enough parasites to wipe out the forest in a few years were things not so nicely balanced, parasites living upon parasites, insects hunting insects.

Every plant pathologist should visit the tropics and take a lesson from the jungle, for if it teaches any one thing it is that inherited resistance to disease and the setting of an insect to catch an insect are the two ways which the jungle species take to escape from their enemies.

#### THE PHENOMENON OF FATIGUE IN THE TROPICS

Having gone to the tropics in midsummer, it was natural to try to analyze the climatic differences between the banks of

the Potomac in August and the banks of the Chagres. I became convinced that the ordinary tools of climatology are not sensitive enough to analyze this difference, just as the chemist's balance can often detect no chemical difference between objects that are easily distinguishable to the palate.

There is a tropical fatigue phenomenon which some people exhibit more quickly than others and which women apparently show sooner than men. Just what it is I do not know, but its results are easily observable. They come generally in the hours between noon and 5 o'clock in the afternoon, and are to the brain what old age is to the eyes. Not only did my eyes blur and have to be rubbed to clear them, but a kind of haziness of fatigue attacked my brain in the afternoon, and try as I would I could not shake it off.

In the morning hours, from 6 to 12, the conditions for active brain-work seemed ideal and I felt ambitious and keen to do things, and there was gener-

ally a period of clear thinking in the cool of the early evening, but from 12 to 4 or 5, there was a pronounced period of extreme fatigue. I wonder if the physiologists have analyzed this effect of a tropical climate, and whether the hours of employment in the tropics really conform to the hours of greatest efficiency.

Hahn remarks in his *Climatology* that "high average warmth, combined with a high degree of moisture, makes the organism sensitive to slight fluctuations of temperature. In dry climates, on the other hand, the organism withstands great changes in temperature without ill effects."

This is in accord with the surprising experience of cold which one feels in the early morning in the tropics, and also explains why if you stand in the shade at the edge of the jungle and the slightest breeze strikes you, it gives you a perfectly delightful feeling of comfort. If you make the slightest exertion your clothes become wringing wet and your glasses are continually covered with moisture.

You get so thirsty that you feel as if there were no limit to what you could drink, and as the cool water trickles down your throat you are almost ready to declare that it is worth a trip to Panama just to have the experience of quenching such a thirst!

#### PANAMA'S JUNGLES AMONG MOST WONDERFUL IN THE WORLD

The jungles of Panama are among the most wonderful in the world, so far as vegetation goes. They are not inhabited by tigers and elephants, as are those of Burma and Siam. They do not have gorillas, as do the jungles of Central Africa; they have not the rhinoceros of Java and Sumatra, but the boa-constrictor is there, and they swarm with those brilliantly colored antediluvian lizards, the iguanas; flocks of parrots and parakeets, and toucans abound. Doves of small monkeys live in the tree-tops, while those weird insects, the leaf-cutting ants, cut their broad pathways like miniature highways of travel criss-cross through its tangled undergrowth.

But it is as rain forests that the jungles on the Chagres might be classed among the most remarkable of the world. They are produced by a rainfall which is, ac-

ording to Hahn, nearly three times that of Rio de Janeiro, twice that of Guatemala City, about twice that of Bangkok or Calcutta, of Port au Prince and Porto Rico, nearly half as much again as Colombia or Hongkong, and considerably greater than Paramaribo, in Dutch Guiana. It is, furthermore, almost double that on the near-by heights of Balboa.

And here we were actually in this magnificent rain forest, in the cool of the early morning.

#### A MINIATURE FACE IN THE TREE TOPS

Not a whisper of wind was stirring. Bands of sunlight crossed the trail like those that penetrate a darkened room, illuminating the very air and making it alive with particles of matter. We stood and listened and looked.

So instinctively does the human eye catch the slightest movement of an object among others which are still, that although millions of leaves shut us in on every side, we both saw instantly a moving leaf in a tree-top from behind which there peered out at us a miniature face.

We recognized at once that this creature with the great brown eyes had a quality that the insects on the trail beneath our feet had not. Suddenly we had come into the presence of a form of jungle life which had at least a resemblance to the form which is covering the globe with cities and cutting down the forests.

It is strange to speculate about this greatest of occurrences—the arrival in the animal world of that organ, the brain, which came into existence, or at any rate found its great beginning, in the tree-tops of a tropical rain forest.

There we two descendants on the ground stood staring at the tiny descendant in the branches. How far, how incredibly far, our pathway of descent had taken us in the thousands, perhaps millions, of years since those days in some tropical rain forest when the first super-apes, more intellectual than the rest, broke into the swift pace of evolution which led to man!

And how that creature in the tree-tops had lagged behind—so far behind that any kinship even seemed more imaginary than real. Yet intelligence was there—the spark, the something, that made of



Photograph by David Fairchild

#### WHICH WAY IS THE BUTTERFLY GOING?

If a bird sees it sitting on a branch, does the appearance of doubleheadedness deceive? And did the ancestors of this butterfly increase their chances of survival in the struggle for existence by their strange appearance, or is it just a coincidence? These questions are hard to decide experimentally.

that tiny creature a very different thing from the insect creatures of instinct at our feet, whose perfect organization is enough to "strike terror to the heart of any individualist."

#### ANTS THAT CULTIVATE MUSHROOMS FOR THEIR YOUNG

There are many differences, botanical and zoölogical, between the forests on the Chagres and the rain forests of the Malay Archipelago; but to me the most striking was right beneath my feet—the beaten trails of the attas, the leaf-cutting, mushroom-growing ants. There are none of these trails in the oriental jungle, for the atta does not inhabit them. There is a mushroom-growing insect in the East, a species of termite, or so-called white ant, which is not an ant at all; but the termites build covered mud runways and not open well-kept highways like these of the attas.

I wanted most of all, in coming to the Chagres, to have two experiences: I wanted to see a real boa-constrictor—see its long, trunk-like body move swiftly

across the trail and watch it disappear among the trees, or look up into some tree-top and see its long, narrow head and the coils of its scaly body far above me in the forest—and I wanted to see the mushroom gardens of the attas.

The boa-constrictor is fast becoming a rare animal on the Chagres, and I did not see one; but I did have the pleasure of digging out an atta mushroom garden.

One may have watched an atta under a lens and have seen it deliberately scissor out a circular disk of green leaf, throw it over its head, and hurry down the leafy twig to the tree trunk or down to the ground, and then away, at the rate of two yards or so a minute, over a beaten highway as clear of leaves as a swept pavement and, compared with the size of the atta, as wide as a city street.

One may have watched it disappear into its hole in the ground, but until he has actually dug down deep into the stiff clay and found there, in subterranean caves, the mushroom beds of these creatures, he can scarcely realize the full





Photograph by David Fairchild

THE GREAT OWL BUTTERFLY WHICH FLIES AT DUSK: PANAMA

When the author first saw the wings of this remarkable butterfly through the camera as he took its photograph, he was startled by its resemblance to an owl's face. Its eye spots seemed almost luminescent and it could easily be imagined that an owl was flying at dusk. If held at arm's length and viewed with almost closed eyes, the reader can readily imagine he is looking at an owl.

length to which the strange force of instinct has carried them, whose form and probably whose gait has not changed in hundreds of thousands of years.

POSSIBLY THE WORLD'S FIRST "AGRICULTURISTS"

There, in the cavern, lies a mass of mushroom spawn as delicate to the touch as cobwebs are, and embedded in it everywhere are the bits of leaf brought by the attas, hundreds of yards over their highways, for its nourishment.

If you take this spawn carefully out into the sunlight, countless groups of sparkling, almost microscopic, bodies are apparent. These are the mushrooms. It is upon these that the baby attas feed. I wonder if these mushrooms are not the oldest cultivated plants in the world, and this cave agriculture of the attas the most ancient of all agricultures.

To enter the great tombs of Egypt and see the mummy cloth of a Pharaoh is to look at the handiwork of beings which lived three thousand years ago, but to open the mushroom cave of an Atta is to

come into the presence of an instinctive agricultural practice which probably began long before the Cave epoch of mankind and has been continued down to the present time.

There appear to be no weeds in the shape of other kinds of mushrooms growing in these nests. How do the attas keep them out, and does the crop ever get diseased, I wonder! It is things like these, which you feel have been going on uninterruptedly for eons with feverish haste, that make the jungle what it is, a place in which to think and wonder.

The little laboratory at Juan Mina, where we spent six days, stands in a citrus grove established there some years ago, and for naturalists to live and work in it is a wonderfully comfortable and convenient place. Carefully screened, equipped with running water and cooking-stove, it overlooks from a slight elevation the famous Chagres River, famous for its deadly black-water fevers, which in the days of the California gold seekers made the trail across the Isthmus, which passes through the jungle behind the laboratory,



Photograph by David Fairchild

A GIANT LIZARD, OR IGUANA, OF TABOGA, AN  
ANTEDILUVIAN REPTILE

The brilliant colors and the curious flopping horns along its spine make you sure that this creature is a left-over from the Age of Reptiles (see text, page 142).

one of the most dangerous spots in the world.

THE FEVER-BEARING MOSQUITO IS  
VANQUISHED

There was a curious thrill of pleasure in being near this spot and feeling safe, safe from that microscopic enemy which when I crossed the Isthmus before was wholly unidentified, unknown, but which now, through the investigations and activities of personal friends of mine, whose early plans and dreams I heard them talk about,

is known and whose ways are understood. To those like L. O. Howard and Theobald Smith, whose scientific curiosity led them into this field of discovery, should go quite as much of credit as to the inventors and organizers like Gen. Gorgas, who mastered the mechanics of mosquito destruction.

I do not mean to give the impression that there is no fever left on the Chagres, for there is; but if one keeps behind well-built screens after sundown and before sunrise, which, according to Dr. Zetek, is the time when the female anopheles fly, the danger here is insignificant—no greater, perhaps, than danger from colds in northern climates.

GRASS PROBLEM APPALS THE  
PLANTER

A Florida orange-grower would turn gray if he had confronting him the problems which face any one who attempts to grow fruit in Panama.

The grass problem alone is enough to stagger the heart of the bravest planter. Think of your own vegetable garden in midsummer, when the days are steaming hot and the weeds are growing about as fast as you can pull them out; project these conditions indefinitely, for there is never any winter to check them, and you will get the endless vista of weeding which confronts the tropical planter.

Grass is certainly the curse of agriculture in the rainy tropics, and he who imagines tractor-work or the use of any of the ordinary tools of our northern agriculture in use on tropical farms should never lose sight of the grass.

There is really nothing so hopeless-looking to a northern fruit-grower as a little orchard in a clearing in a tropical jungle. The great forest insists on taking back the little clearing to itself, and it is one continual fight with a machete to keep it from doing so.

When I was shown what looked from the deck of a launch like virgin forest,



Photograph by David Fairchild

## SIX GIANT LIZARDS, THE BAG OF A SUNDAY MORNING

Why any one who eats eels and terrapins and snails should shudder at the idea of eating lizards is hard to understand; but many do. To the Taboga people they are as great a delicacy as the terrapin is to us.

with great trees covered with creeping lianas, and was told that it had all grown up in eight years from cleared land, and when I recollected how fungus and insect pests haunt a clearing, I could better comprehend the feeling that, after all, for the individual of small means, there really is no other way to farm than to cut down and burn, plant and get a crop or two; then, when the plants and weeds of the returning forest drive you out, move on. It is the way of the native everywhere; clear a spot, rush in, rush out again, and let the land grow up to trees.

## UP THE CHILIBRE RIVER IN A CAYUCO

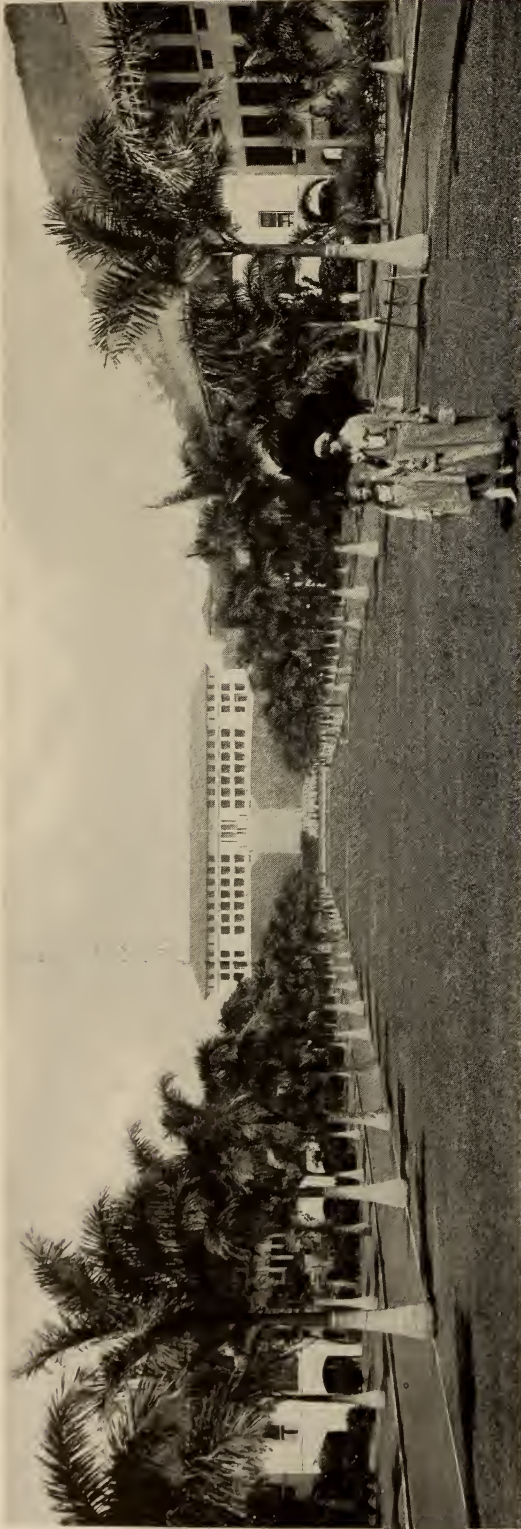
To paddle up a strange river in a canoe is thrilling, even in the north; every turn in the stream opens a new vista. But to sit in a real dugout made from a giant tropical forest tree, with the beautifully developed, half-naked form of an Indian in front of you, where every move of his lithe body changes the shape of the brown statue before your eyes; to be so near

the dark, still, swift water that your hand touches it and can pick up floating fruits as they pass, and noiselessly to thread your way under palms and great lianas up a tropical stream, is an experience of a lifetime.

Hushed by the stillness of everything, nerves keyed up by the instinct which comes when you take a gun in your hand, and guided by natives whose eyesight is so keen that they can see a green snake lying on a branch forty yards away, my son (Graham) and I pushed up the Chilibre, and up it to the Chilibrillo, in a cayuco.

Not in those parts of Java or Sumatra where I have been, nor in the South Sea Islands, nor anywhere around Rio, not even in the Moluccas, have I seen anything which approached the luxuriance of the banks of vegetation between which we were noiselessly gliding.

"Culebra! Culebra!" whispered the Indian in front of me, and we darted under overhanging branches to get a



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THE ADMINISTRATION BUILDING AND THE APPROACH THROUGH THE ROYAL PALM AVENUE; BALBOA, PANAMA

When will some genius of landscape gardening be given an opportunity to use the plant forms and colors of the tropics? This palm avenue will grow more stately with age. It is a fragment of the unfinished plans for the landscaping of Balboa.

closer view of a tree-snake which refused to come down, even after being shot at.

A few yards farther up stream one of those weird, unworldly green lizards lay flattened against a limb. A 22 shot brought it down into the undergrowth and we pulled into the slippery mud bank to get it. A parrot in all its gorgeous plumage is no more brilliant than one of these great lizards of the Chilibre. They must be seen before their colors fade to be appreciated; when stuffed they look like any other reptiles.

With varied luck and exciting incidents we pushed on to where the Chilibrillo enters the Chilibre and branched off into the smaller stream, so narrow that in places the fallen tree trunks almost blocked it, and as we stooped to avoid the hanging vegetation we involuntarily scanned it for snakes, which love to lie on the branches projecting over the water.

#### A NATIVE HOME IN THE JUNGLE

We left the stream and followed the Indians to a typical native house in a clearing in the jungle.

It was with a peculiar feeling of racial curiosity that I walked around this little farm-yard in the jungle on the Chilibrillo. There, in a hammock swung between the posts that supported the thatched roof, lounged the woman, and in the little patch of upland rice near by worked the man, cutting the long heads of half-ripe grain one by one with a small knife.



Photograph from Roscoe Searle

DEFEATED BY THE MOSQUITO AND ABANDONED TO THE JUNGLE

This French dredge was the giant of its time. It had to be abandoned, and the jungle has smothered it, because the engineers who built it had not counted on the mosquito. The discovery that the mosquito is a carrier of parasites constitutes the real beginning of the White Man's conquest of the Tropics.

The palm-thatched roof covered a closed-in room and an open one. A fireplace, a wooden pestle and mortar in which to hull the rice, a table of peeled poles, a little storehouse near by, and that was all.

I turned away from this primitive farm-yard with doubt that from such homes as this will ever come the human stuff which will master the tropics.

An approaching thunderstorm, with its banks of threatening clouds and claps of thunder, so characteristic of the summer season, hurried us back to the cayuco, and noiselessly we slipped downstream.

Graham had winged a Jacana, which dropped into the tall grass on the bank, and had just landed to get it when something so blue that it startled me flashed in an irregular course over my head and alighted somewhere behind a clump of trees on the edge of the swamp. I had never before seen a live morpho butterfly.

I had not realized that seeing one would be comparable to one's first sight of a ruby-throated humming-bird; but it is, and the excitement of that wholly unequal chase, handicapped as we were by the swamp, and our bitter disappointment at seeing the gorgeous thing, like a flash of blue sunlight, disappear into the forest, constituted one of the most vivid experiences of the whole trip.

#### THE BEAUTIES OF TABOGA ISLAND

Taboga was a great surprise. I was told that it was worth seeing; that it had a drier climate than Panama, and that delicious pineapples grew there; and Graham had been shown specimens of the gigantic bird-catching spiders which Dr. Zetek had said would jump at any one who disturbed them in their lairs beneath the rocks. But nobody prepared us for the peculiar beauty of this charming little island in the Pacific. The charm of it lies in its blending of Mediterranean architecture and tropical vegetation.

Here, clustered in a little valley surrounding an incomparable little beach, like the beaches of the Adriatic, was a century-old tile-roofed town with every line in it harmonious. I felt as if we had stumbled into a bit of old Spain.

The moon was just rising out of the sea when we landed, and our first glimpse was of the little plaza in the town. There

were the youths and maidens, the evening social promenade, the sea, the soft Spanish voices, and the heavy perfume of the tuberoses in the borders. I thought of Funchal and Amalfi and of little villages on the Adriatic, but everywhere the palms and giant mangos and sapodillos broke the illusion and added an indescribable beauty to the scene.

But I cannot possibly condense into a few pages the impressions of a month in Panama. To my mind the Canal Zone is an oasis, spiritual as well as physical, in the very heart of the humid tropics. It is an oasis which has been built on a sufficiently large scale to show what can be done toward making a tract of land four times as large as the District of Columbia as safe a place to live in as the District itself, although surrounded on all sides by tropical jungle in which lurk all kinds of diseases which have for centuries devoured the white man whenever he has ventured into its shadows.

#### OUR COUNTRY'S ATTEMPT TO CONQUER THE TROPICS

So far as I have seen, this is the first time in history that a northern race has comprehended, and shown that it comprehended, the gigantic scale upon which it will be necessary to operate if the white races ever conquer the tropics.

Much has been said about the inability of the white race to live there. Perhaps it cannot live there as the brown and black races do; but, for all that, it can and will accomplish great changes; and the development of the Panama Canal Zone, with its sanitation, transportation facilities, its admirable hotels, and its stirring intellectual life, stands as a brilliant example of what the future may bring in the development of the gigantic resources of the tropics.

It is from this standpoint that I think one should view the accomplishments of our country and urge it to go on with the research work which it has begun, and make here, in this frontier post, the discoveries without which the scientific conquest of the tropics will be impossible.

We have greatly underestimated the problem of the tropics. It is one which should invite the greatest research talent which we have and be supported by our millions. The agriculturist who tackles



Photograph by David Fairchild

A FEW MINUTES AFTER SIX: MORNING SCENE AT TABOGA, PANAMA

With some of the character of a South Sea island, but with a century-old civilization, Taboga is the picturesque gem of this whole region, and at sunrise its coast has few rivals in tropical beauty.

the jungle single-handed and tries to farm within its shades is about as likely to succeed as would the man who tried to raise turkeys in a game preserve.

The parasites are legion; they attack every form of plant and animal, and most of them can only be seen through the tube of a microscope. It will constitute the life-work of hundreds of research men to find out their habits and how to circumvent them, and one of the best places in the world to do this could easily be the

Canal Zone, were it only equipped with the special laboratories, insectaries, plant nurseries, trial gardens, and other paraphernalia of biological research.

If this work were to be handled on the same large and comprehensive scale that has characterized the engineering operations on the Zone, and not on the small unit "Experiment Station" basis, the world would be amazed at the results, just as it is today at the magnificent work of American engineers.