NATURAL HISTORY

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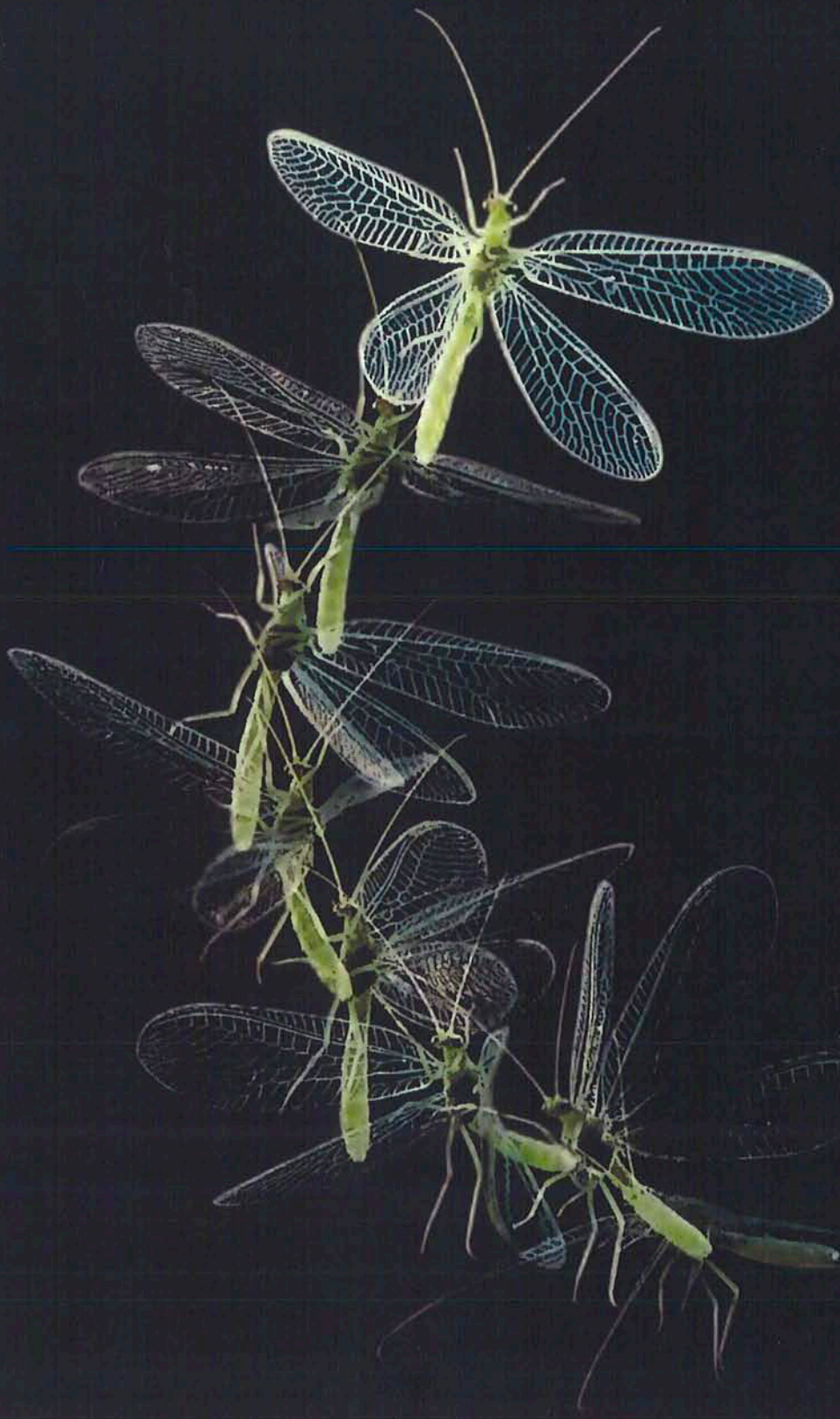

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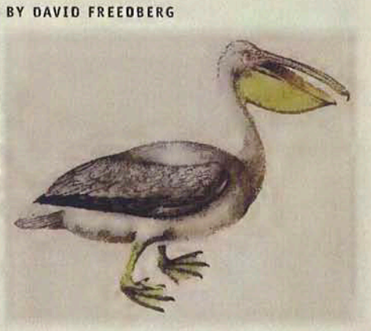
FEATURES



COVER: A green lacewing takes flight. The vibrational "songs" of this and other insects are beginning to be deciphered.

STORY ON PAGE 52

PHOTOGRAPH BY KIM TAYLOR; BRUCE COLEMAN, INC.

TO MARKET,

Bacuri are like potato chips: you can't eat just one. When Clemente was a kid, he and his buddies would swipe a canoe from a neighbor, paddle across the river, and scramble up the opposite bank to reach the forest trees that bore this mango-sized fruit, with its sweet white pulp. There they downed bacuri by the dozen and toted even more home. But none of the fruit ever reached a market. Located in the Brazilian rainforest on a tributary of the Amazon, Clemente's village was, until recently, accessible only by boat. The nearest town was across the river and seventy-five miles away overland; many village folk never set foot there during their lifetimes.

Now a married man with eight children and another one well on the way, Clemente surveys the changes wrought by an influx of loggers and ranchers. The land across the river from the village is burned and badly shaved, and in place of thousands of trees stand a few head of cattle. Beyond the blackened stumps, rough logging trails pierce the remaining forest, winding their way to one of the region's sawmills. Cash poor and under heavy pressure from the loggers, some village leaders have sold off timber from the twelve-square-mile tract the community holds on this side of the river. One man gave up fifty acres of trees for a rustic stove; another traded seven *piquiá* fruit trees (worth $700 as sawed wood) for one injection for his sick son.

Clemente and his fellow villagers have long harvested and used the vines, medicinal plants, fruit, and game offered by their forest, but because of these desperate deals, the number and diversity of trees and game animals within their tract is diminishing. Could the sale of forest fruit benefit them more than the sale of trees, providing cash while salvaging the rest of the forest? The economic potential of such

TO MARKET

Story by Patricia Shanley ~ Photographs by Joel Sartore

products has been a hot topic among conservationists the world over, who call them non-timber forest products, or NTFPs. Juices, preserves, candies, ice creams, and body oils featuring exotic ingredients have already begun to appear on the shelves of distant shops. Fed up with unfavorable timber deals, the villagers are ready to try something new.

Until now, the villagers' principal marketing experience has been with cassava flour, a staple created from their main agricultural crop through an arduous baking process. They sell more than half of what they produce to a middleman who reaches the village by boat, but their efforts earn them little. As an ethnobotanist and part of a team of ecologists researching ways to slow deforestation, I have been invited to help inventory the resources of the village forest. Among the scores of tree species whose fruit is consumed locally, we identify three—*uxi* as well as bacuri and piquiá—that hold real sales potential. Distant policy makers, however, have failed to reckon with the pitfalls this new enterprise may encounter and to anticipate the practical lessons that must be learned.

Overleaf: A *piquiá* is offered for sale at a market. Inset: Antonio with his harvest. Right: Antonio and Jaime gather *uxi* while Tyanca, below, collects *bacuri*. The trick to harvesting in the rainforest is to find and gather the ripe fallen fruit before too many birds, mammals, and insects have attacked the feast.

The villagers' marketing venture begins as Clemente's nephew hears the sound of a truck across the river and paddles to the ranch upstream to investigate. He comes home with the news that the truck will be going back to town in a few days and that there will be room in it for people and products. We are smack in the middle of Amazonia's rainy winter, the season of forest fruit. The villagers see it as a rare opportunity. But the following morning, as the pink sun rises over the muddy river, Clemente enters my hut to ask, "So where are the fruit trees?"

Most of the large trees that once stood near the village have been destroyed—trucked away or loaded onto barges by logging companies. Others have been cut down to build canoes or to make room for small agricultural fields. Accustomed to gathering fruit only for their own use, local families have been relying on a relatively small number of trees. Today they need to find more, all with ripe fruit. But forests are not orchards, where trees of the same species grow conveniently in one place. And while some villagers, especially hunters, know where to find the scattered trees, others do not.

Clemente and his friend Branco have to walk two to three miles, past quiltlike patches of overgrown abandoned fields, to find suitable trees. With increasing disappointment, they inspect one piquiá tree after another. The timing and volume of fruiting varies enormously, both between and within species, and the odds of any one tree producing fruit in a particular year are not good. After two hours, the men have passed twelve enormous piquiá trees, but only three have fruit; the total fruit count is just seven. At a prospective ten cents a piece, this is not a huge haul.

Beneath piquiá number twenty, however, the men spy close to a hundred pieces of fruit. Softball-sized and tan with a greenish tinge, they lie scattered 100 to 130 feet below the massive winding branches from which they have fallen. Clemente opens one that has crash-landed on a log. Its thick rind has been smashed, and the pulp inside is bright yellow. He sniffs it: yes, sweet. He and Branco quickly gather seventy-nine.

This year the piquiá *(Caryocar villosum)* and bacuri *(Platonia insignis)* trees with high fruit yields happen to be growing at the farthest limits of the village tract of forest. Pacas (burrowing rodents), parrots, armadillos, and ants have had first shot at these trees. Fortunately, both bacuri and piquiá, because of their thick skins, survive intact for days on the forest floor. The men also find and collect the egg-shaped fruit of the uxi tree *(Endopleura uchi)*. These have a fine skin and require quick pickup. The grainy flesh is a fast food for forest squirrels.

In the shade of the wet forest, with mosquitoes biting their arms and legs, the men gather the fruit and quickly throw it into large, woven plastic sacks. Carried slung over the back, each filled sack weighs about 175 pounds. Finally Clemente and Branco begin their circuitous three-mile return to the river. The heavy sacks rub against their backs and arms; bruised by pressure, the thick rinds of the piquiá and bacuri begin to ooze, staining clothes and irritating skin. The trails are often flooded or suffocated by vegetation that has sprung up following the heavy rains. The men move with caution; the rains have drawn out a variety of snakes, which inhabit the trails, puddles, and brush.

Reaching the village at last, Clemente and Branco drop the sacks onto the ground outside their homes. They toss some damaged piquiá fruit to a pack of hungry kids, who scoop up the treat and rush off to boil the oily pulp in a pot of river water. The remaining fruit is packed tightly into sacks that are tied closed with vines. Clemente unearths a nub of charcoal from the damp earth and slowly initials each bag.

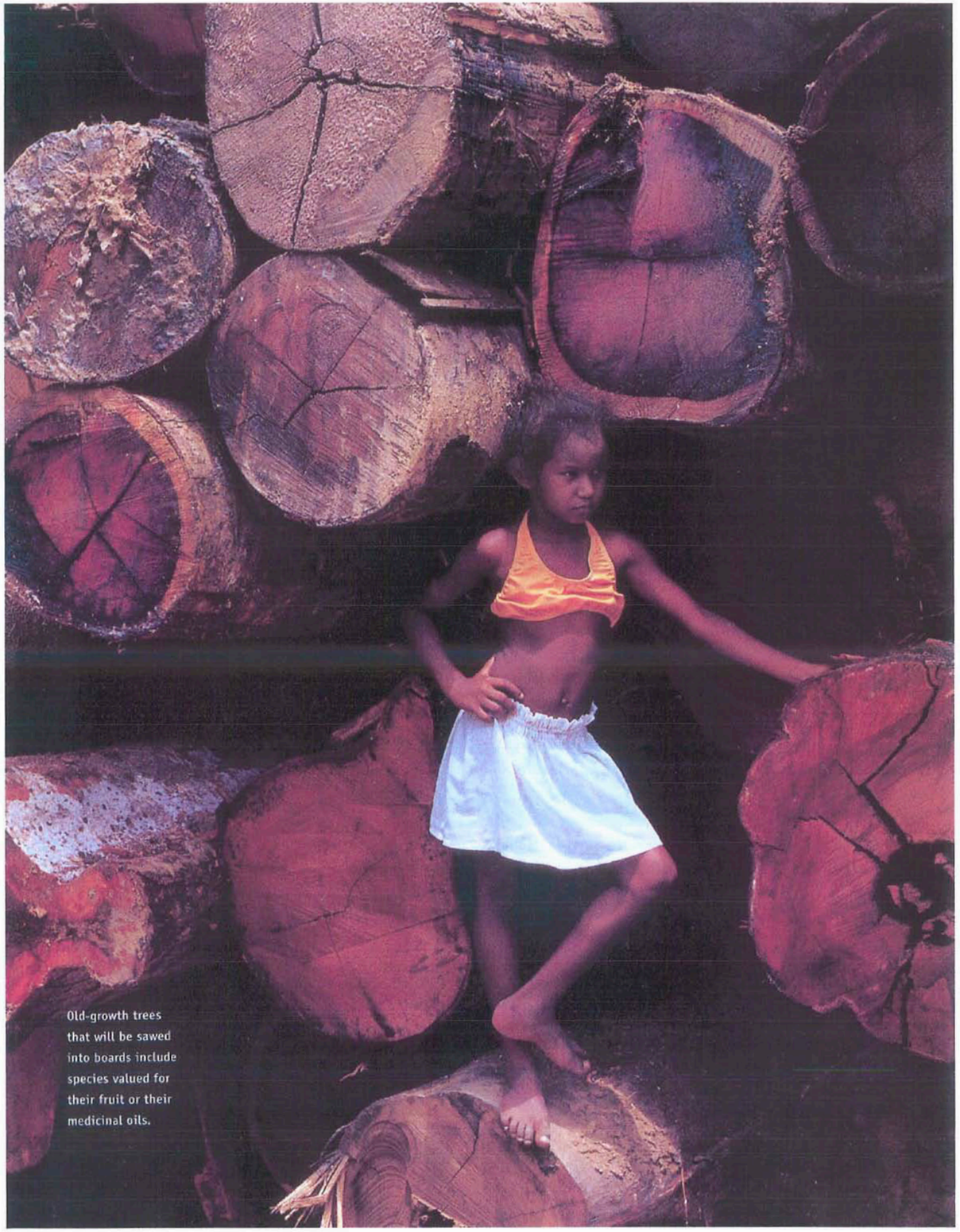
After three days, some 2,400 pieces of fruit have been collected by Clemente, Branco, Beca, Curumi, and several other village men who have joined the enterprise. Having heard about fruit loss caused by transport in sacks, Clemente and Branco decide to package some of the fruit in boxes. They collect thick slabs of forest trees previously cut for home construction and rig these together using nails they beg from neighbors or scavenge from the soil. With the butt of a machete, Clemente pounds the rusty nails into the hard damp wood. He dumps fruit into the box, conjures a lid out of remaining wood scraps, and seals it all with thick

The shelves of distant shops are ready to receive the products of the Amazonian rainforest, but who will get them there?

forest vines. Stars and a cuticle of moon appear, casting pale light. The wooden crates are enormous.

Under the faint moon, a new crisis arises: Clemente's wife begins her labor. The whole scheme is in danger of collapse if someone cannot be found to take his place and accompany Branco and another man, Nego, on the trip to the market. Beca refuses to go, so Clemente decides to awaken Neginho, known for his cooperative nature and his interest in the fruit sale. As his family sleeps in hammocks behind him, Neginho stands silent and immobile, wanting to respond favorably but pondering, troubled. As Clemente walks away, it suddenly occurs to him that Neginho is not good with numbers. In villages along the river, perhaps more than 70 percent of the population have had no schooling. This—together with the villagers' general lack of market experience—cancels out many candidates. Clemente returns to Beca, who has collected the largest share of fruit. Clemente warns Beca that his profits from the sale may be in jeopardy if he does not go with them. Finally Beca consents.

Before dawn, Beca and Clemente, bending beneath loads of fruit, feel their way down a red-ant-infested trail to the riverbank. There they pitch the bags and coffinlike crates into their canoes, which rock under the weight, taking on water. Beca's wife, Lucia, descends the slippery bank, removes a worn slipper, and



Old-growth trees that will be sawed into boards include species valued for their fruit or their medicinal oils.

uses it as a scoop for bailing. The canoes sink deeper in the water as the men clamber in.

The destination is the truck, two and a half miles upstream. Swollen by the rains, the river flows swiftly. But there are no mishaps, and three hours later, with the help of seven men, the truck has been loaded. Clemente watches as his friends depart; seventy-five miles of uncertain logging roads lie ahead. The winter brings not only rain and falling fruit but collapsed bridges, overturned logging trucks, and lost lives.

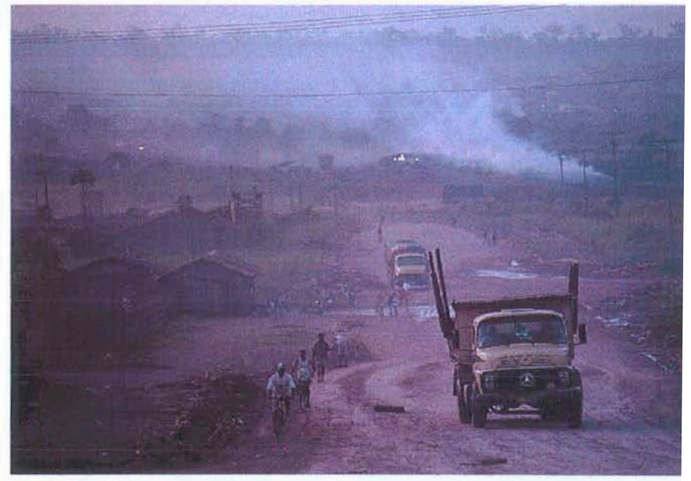
This day the journey goes well, and the truck reaches town within four hours. Pulling up to the muddy, rambunctious marketplace, Beca, Nego, and Branco glance about. Milling around are hundreds of poor, hopeful farmers. Some sell cassava flour, some fish, some fruit. By now it is past midday, and the sun is high. Trade began six hours earlier as light first touched the vegetables, dust, and dogs. In the cramped marketplace, competition for space is intense. Free to roam twelve square miles of village forest, Beca and his comrades have had little practice brandishing elbows. Their inexperience and heavy loads combine to settle them away from the best locations.

Most families in Clemente's village sell cassava flour, which travels well. Fruit is likely to bruise, break open, or rot. In the commotion surrounding the new undertaking, the quantity of fruit, not the quality, was paramount. The fruit was not washed, dried, selected, or carefully packaged. More than half is spoiled. Meanwhile, freeloaders posing as taste-testing customers visit only to fill their stomachs with fruit samples.

Nonetheless, true customers do appear. A wizened former farmer, accustomed to the taste of uxi on her lips each winter, approaches the stand, happily requesting sixty fruit. Sixty? What can we put them in? While Beca stands guard over their products, Nego and Branco run between makeshift stalls, kicking up dust as they go. With the scant change they carry between them, they purchase twenty-five thin plastic sacks. Christened, they return and await more trade.

At a loss when it comes to prices and numbers, Nego is little help at the booth. He is large, young, and hungry. Beca lets him go. He scouts work and finds some. For eight hours he runs hunched over, carrying 130-pound sacks of cassava flour from truck to market. He spends his earnings on a meal of rice and beans with a sliver of meat and a handful of cassava flour.

At dawn the following day, with nothing to show for his efforts, Nego catches a ride atop a logging truck and heads home, while Beca and Branco linger at the market. When evening comes, the two men drag their unsold fruit to a deposit area. From there they enter a



Cash-poor villagers are under pressure to sell off their timber rights. One man traded seven fruit trees to get an injection for his sick son.

Lumber mills, above, have an insatiable appetite. Cassava fields prepared by the slash-and-burn method, left, yield sustenance as well as some cash income for a village community.

cement-walled room filled with hammocks. As latecomers the previous night, they had to hang theirs close to the latrine. Mosquitoes orbit their sweaty heads, and the smell of rotting vegetables and urine surrounds them. Exhausted, they fall asleep.

In the morning, Beca and Branco rise early, scramble to the deposit area, and move the remaining fruit to their stand. Lowering the price to liquidate what will soon rot, they sell as much as they can and throw the rest into the gutter. They spend one more night in town and set out for home the next day. What is their net gain? It is hard to know. Meals and several nights of drinking sugar-cane alcohol have eaten into their earnings. By the time Beca and Branco, coated with yellow road dust, have made it back to the village aboard a log-

As long as the forest survives, villagers will collect vines, tap trees for medicinal oils, hunt game, and eat the wild fruit.

An herbal poultice applied to an injured foot, above, helps reduce swelling and prevent infection. Right: At a workshop on medicinal plants, women learn how the forest provides remedies for their families as well as marketable products.

leased the bulk of their weighty harvest. The fruit that has not already been eaten by forest creatures is bursting open and rotting on the forest floor. Barefoot, the women carefully pick their way around the red ants and putrescent fruit. Pooling their joint knowledge of the forest, they recall which trees bear late in the season and locate them, rescuing the last of the year's yield. Antoninho, a male relative and a natural entrepreneur, agrees to accompany them to market.

They have learned from the first sale. Fruits are selected, washed, and left to dry. Small boxes of thin wood, with leaves for cushioning, are used for transport. The women leave the village at night, arriving in the city before dawn. They fight their way to the prime sales area. This late in the season, there are no other farmers selling forest fruit, so they now set the price, doubling what the men had asked. Taste testers who have no intention of buying are rebuffed. An ice-cream shop owner purchases all of Theodora's bacuri and promises to buy any others she may bring. The women sell their 268 pieces of fruit, go shopping for exactly what they had planned to buy, and return to the community the next day.

One month later, proudly wearing used clothes purchased with fruit money, members of the mothers' club accompany me to another river community to talk about the practical benefits of their forest fruit sale and the findings of my ecological research team. One sack of fruit, we can report, brought ten times the value of a sack of cassava flour for less than a tenth of the time and effort, and the sale of only seven bacuri gave a return equal to what a logger had offered for an entire tree. Fruit that certain village families eat regularly, while not placing money directly in villagers' pockets, amounts to a substantial invisible income. Laughter rings out as Mangueira, a full-bellied fellow, estimates that he and his family have eaten more than 3,000 pieces of forest fruit in one month alone.

Village hunters tell our team that the flowers and fruit of many forest trees "call" wildlife. In one month, for example, three villagers caught 170 pounds of game under fruit trees. Others mention the medicinal value of fruit, how it chases away flu and other sicknessess that might otherwise require costly remedies.

By the time Theodora rises to speak, it is dark. A small oil lamp shines light on her blue-and-white lace skirt. Unaccustomed to attention from a crowd, she talks quietly, timidly. She begins by relating what the sale meant to the mothers' club and tells of gathering the fruit, of laughter and singing under the trees. She talks about the lack of any gain from timber sales, of continual impoverishment, of sweating day after day in the production of cassava flour only to sell the product for a pittance. Although their earnings from fruit have been modest, says Theodora, they have not been cheated. This time they did not sweat only to be robbed.

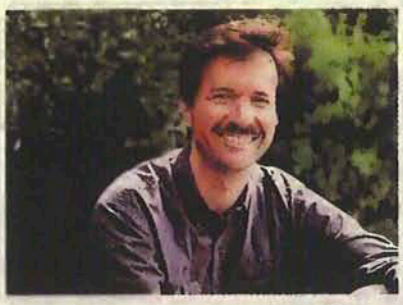
Applause breaks out in the darkness. No, these villagers will not all take fruit to market. They will not all have the time, the transport, the means. They will not all wear "fruit clothes." But they know now that selling off timber is not the only way to earn cash from their trees. And as long as the forest survives, the villagers will all be able to tap trees for medicinal oils, collect vines, hunt game, and eat wild fruit.

Postscript: *After this article was written, men in Clemente's village, desperate for cash during a season of poor crops, sold timber rights to many trees in their village tract. The scant profits bought radios, bicycles, and alcohol but did little to ease hunger. Village matriarch Dona Ana, who was away at the time, was infuriated. She spoke out against any further timber sales. Since then, to help save communities like theirs from a similar calamity, I have worked with women from this village and others in the area who have come together to share their new ecological and economic awareness. Responding to requests, the group, known as the Mulheres do Mata (Women of the Forest), travels by foot and canoe to conduct workshops in eastern Amazonia. Villages that have taken part have improved their forest management through increased use and processing of forest fruits and medicinals, through negotiating more advantageous terms with loggers, and by creating community forest reserves. Research results, songs, and posters presented in the workshops have also been incorporated into illustrated books, useful even for nonliterate audiences. The women's work has garnered attention from organizations elsewhere in Latin America and in Asia and Africa as well.* □

Jaime, a boy whose family maintains a forest reserve, holds a piquiá.

Wildlife biologist **Richard Parnell** ("Gorilla Exposé"), a native of Sussex, England, has spent most of the past decade on the trail of lowland gorillas, first in Gabon and currently in the Republic of Congo. After years of following the apes through dense forest, he describes his current research site—perched on a tower above a clearing known as Mbeli Bai—as a "retirement home for gorilla trackers." A research fellow with the Wildlife Conservation Society, Parnell believes that gorillas have been "underestimated as nice but rather dim salad crunchers." Parnell is a doctoral candidate at Sterling University in Scotland.

For her first project involving ethnobotany, **Patricia Shanley** ("To Market, to Market") spent ten years working with underprivileged youth in central New Jersey. For most of the past decade, however, she has been involved with rural communities in the Brazilian Amazon, where she has been researching the changing use, ecology, and value of forest fruit and medicinals. While completing a doctoral dissertation for the Durrell Institute of Conservation and Ecology at the University of Kent, Canterbury, Shanley has also been developing ways to make her findings available to the Amazonians themselves so that they can reach better-informed decisions about how to allocate their resources. **Joel Sartore,** a native of Nebraska, is a contract photographer with *National Geographic,* for which he covers land-use issues and wildlife. His photographs were featured in *The Company We Keep: America's Endangered Species,* by Douglas H. Chadwick (National Geographic Society, 1996). Sartore's work has also appeared in such magazines as *Audubon, Life, Time, Newsweek,* and *Sports Illustrated,* as well as in Troll Communications' *A Day in the Life* book series.



Rex Cocroft ("Thornbug to Thornbug") suspects that part of his interest in acoustic communication in animals comes from years spent studying music in college. He recently accepted a position as assistant professor in the Division of Biological Sciences at the University of Missouri-Columbia, where he plans to continue working on treehoppers. His current research goal is to understand how communication between individuals in these insect groups serves as a means of cooperation or conflict and how their interactions are determined by their social structure and ecology. Cocroft's enjoyment of the intellectual challenges of his work is matched by an "irreducible appreciation of the animals themselves, which are so different from humans that trying to understand their world is a continual stretch of the imagination." Because there are so many species of insects and many of them are so little known, says Cocroft, "the research frontier seems almost limitless," full of wonderful surprises and opportunities to address questions about the function and evolution of animal behavior.

David Freedberg ("The Paper Museum"), a professor of art history at Columbia University in New York City, is editor of the multivolume catalog of Cassiano dal Pozzo's natural history drawings being published by Harvey Miller Publishers under the auspices of the Royal Library at Windsor Castle. As a result of the fortunate accident described in his article, the author discovered that Cassiano was not only a patron of the visual arts but also a passionate investigator of the natural world. Freedberg's best-known book is *The Power of Images: Studies in the History and Theory of Response* (University of Chicago Press, 1989). *The Eye of the Lynx,* his forthcoming book from the same publisher, examines the role of Galileo and his associates (including Cassiano) in creating the modern field of natural history.

As a diver and nature photographer, **Dan Welsh-Bon** ("The Natural Moment") has long been interested in ocean life. More recently, while working on his master's degree in marine and environmental science, Welsh-Bon began to study fluorescence and symbiosis in sea animals. He photographed the shining creatures featured in the larger image this month with a Nikon N-90 and 60mm macro lens and used a Leica epifluorescence microscope for the smaller one. In the past, Welsh-Bon has worked as a volunteer diver at the Monterey Bay Aquarium and as director of a photography program at Catalina Island Marine Institute in California. He has taught scuba diving and underwater photography as well as outdoor, hands-on science classes. Starting this fall, he will bring his skills directly to the classroom as a science teacher in Santa Cruz, California.