INSTITUTE OF CURRENT WORLD AFFAIRS

GSH-19: Jari II

Apartado 8-3870
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Mr. Peter B. Martin
Executive Director
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Wheelock House
4 West Wheelock Street
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Dear Peter:

Major changes at Jari have occurred since Lynne and I made a visit in 1979 (GSH-12). Perhaps the most dramatic change is Mr. Ludwig's decision to sell Jari. Company officials attribute Mr. Ludwig's decision to Brazilian government "red tape" and a failure to fulfill promises made to Mr. Ludwig. Non-company observers point out that Mr. Ludwig's investment in Jari (nearly one billion dollars) far exceeds early plans and that profligate spending and poor management have contributed to the difficult financial position of the Jari operation.

Management efforts to drastically cut overhead costs include permission for third-party involvement in special services and civic amenities. The commercial airline, TABA, handles much of the airline service between Belém and Monte Dourado. Private ownership of cars is now fairly common in Monte Dourado and contributes to a flourishing taxi business. Gas station, restaurant and guest facilities are now leased to private parties. However, the company is still burdened with medical services, schools, sewage and potable water systems, street maintenance, garbage collection, etc. Jari is pushing for creation of a municipality to raise taxes and distribute revenues and services.

As part of a cost-cutting program, the number of Jari employees has been cut from 7,000 to 3,000; a concomitant decrease has also occurred in the larger contract labor force. The rice and mining divisions have been split off from Jari as separate companies, permitting Jari to approach break-even financial status. Company officials state Jari Florestal would be in the black if they did not have $50 million annual debt servicing.

Our September '81 party visiting Jari included my wife, Lynne; Mike Thomas, a close friend and commercial flower grower in Costa Rica; Jack Ewel, professor of plant ecology at the University of Florida; and Anthony Anderson, Jack's graduate student studying the babassu palm in Brazil's Maranhão state. We were very capably hosted by Robin Collins, head of the forest management division, and his staff. Our 3½ days in Jari were largely devoted to visiting many of the plantations and experimental sites. Robin did not hesitate to show us the bad with the good, hence I think we came away with a particularly well-balanced perspective of Jari's plantation operation. Jack Ewel's expertise on tropical soils and nutrient cycling and Mike Thomas' nursery experience provided useful information to Jari personnel.

Gary Hartshorn is a Forest & Man Fellow writing on man's relation with the forest resources of tropical America.

Second Rotation Melina

In 1979, I was impressed by the vigorous regeneration of melina following the first harvest. We inspected a few of those 2½ year old melina stands on good soils and found them impressive. Growth rates are good with the largest individuals coming from stump sprouts. Natural regeneration from seed appears to be contributing 40-60% of the melina volume in the second rotation (crop) (Figure 1).

In contrast to melina on good soils, the second rotation of melina on intermediate sites is not doing well (Figure 2). Growth appears to be lessening appreciably after about one year. We visited some second-rotation melina stands near Munguba (location of the pulp mill) that Robin says appear to have stopped growing. Company policy is to convert the intermediate sites to eucalypt (see later section).

A serious disease problem has developed in second rotation melina caused by *Ceratocystis fimbriata*, a canker-causing fungal pathogen. The fungus usually invades the wood through wounds or other openings in the bark. Jari foresters found a high incidence of cankers (swellings of dead wood) associated with pruned branch stubs or stump sprouts. The abandonment of silvicultural pruning appears to be reducing the incidence of *Ceratocystis*-caused cankers in the melina plantations. Even better control has been obtained by light burning; the young melina is cut when 1-1½ meters tall, then burned after it is dry. Apparently the fungus attacks vigorously-growing stems, but is killed when the light fire consumes the small stems. The light burn does not damage the stumps, that sprout vigorously after the burn. Previously infected stumps are not showing signs of infection after the light burning.

Leaf-cutter ants continue to be the primary pest problem in Jari's tree plantations. Harvest operators find numerous patches of trees stunted or killed by leaf-cutter ants. Until recently, Jari concentrated leaf-cutter control measures to the first few years of plantation establishment. Jari management now says that the policy of more intensive management of plantations includes active ant control during the entire plantation cycle. To give an idea of the magnitude of the leaf-cutter control program in 1980, Jari used 250 tons of Myrex, a poisonous bait. Jari also "gases" large ant colonies.

Late on a hot and dusty afternoon as we drove to the western end of Jari's extensive road system, I vaguely noticed something different about the passing trees. Jaded by dozens of kilometers of pine, eucalypt and melina (Figure 3), I assumed the tall, straight trees to be a different species. Upon stopping, we were amazed to see they were melina; that's right, beautifully tall, straight, and limb-free melina from improved seed (Figure 4). I recalled a 1979 road-side glimpse of selected melina trees in a seed orchard and these were the progeny of those superior trees. Jari foresters later told us this excellent stand (Figure 4) was showing about a 25% gain in wood volume over unimproved melina on similar sites. It's too bad Mr. Ludwig may never return to Jari to see the striking results of just the first phase of genetic improvement of melina.

Jari Pulp Shortage

The pulp mill and power plant towed on separate barges from Japan to the Río Jari began functioning a month before our 1979 visit; hence we had not toured the plants. This time we had an instructive tour of both the power plant and pulp mill (Figure 5). Rated at 750 tons/day of dry pulp production, the modern mill

Figure 1 Above. Excellent melina regeneration from stump sprouts (e.g. large stems on right) and from seed (center). This second rotation melina is 24 months old and on a very good site (site index of 25). Jack Ewel and Mike Thomas in this photo.

Figure 2. Stagnated second rotation of melina on a poor site. Because tree growth is low, sites like this one are being converted to eucalypt. Jari forester, Ing. Sciadelli in this photo.

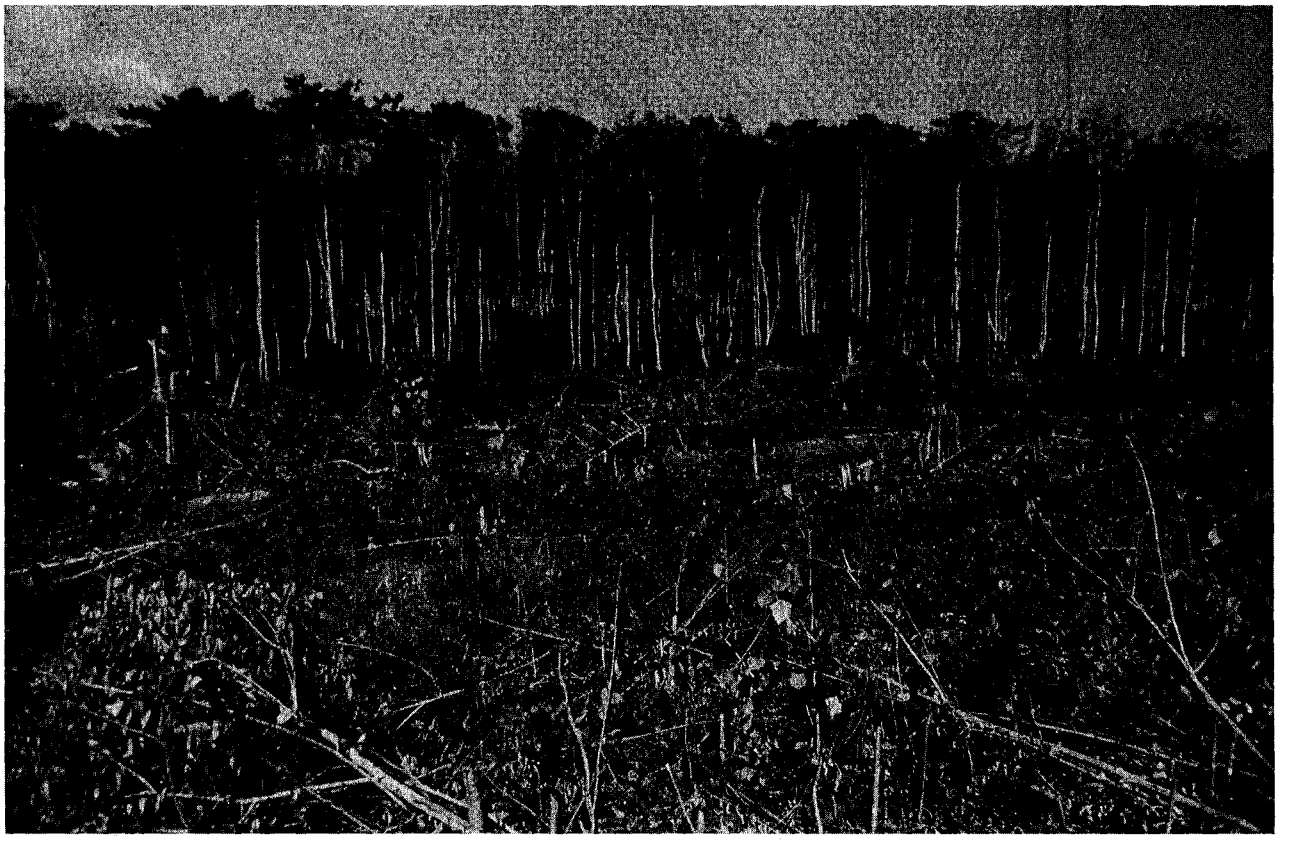


Figure 3, Above. Six-year old, first rotation melina now being harvested. This is a fairly good site that will remain in melina.

Figure 4, Below. Three-year old improved melina on a good site. Note the straight, less-limby boles and size of trees compared to the unimproved melina trees in Figures 1 & 3. Anthony Anderson in this photo.

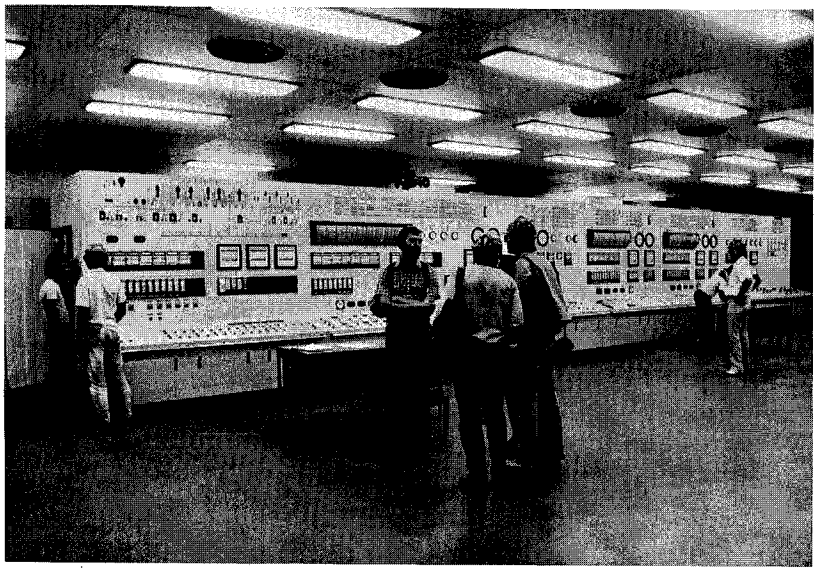
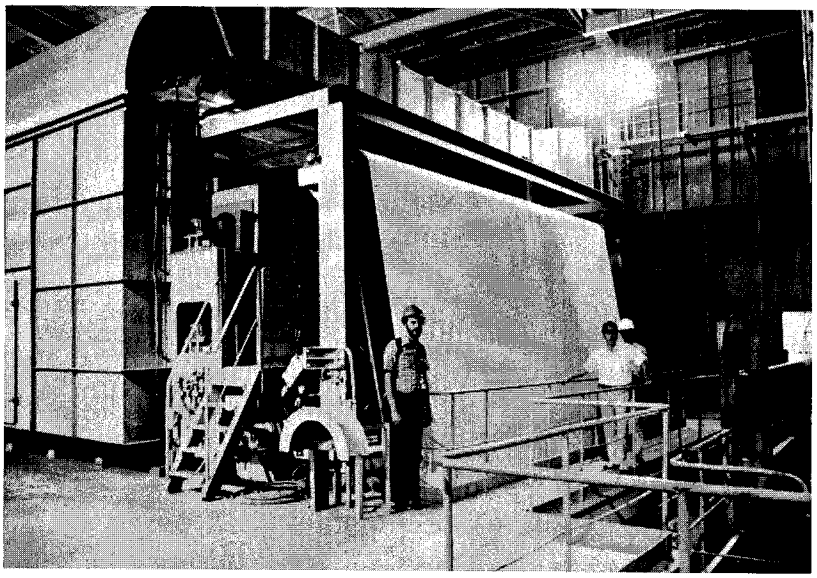


Figure 5. Top, View inside one of the control rooms for the energy plant.



Bottom, Gary and Mike at the pulp plant; the pulp goes from here to a cutter and is sliced, stacked and packed for shipping.

frequently exceeds 800 tons daily production of pulp. The ratio of melina pulpwood to pulp is about 5:1, hence about 3,600 tons of pulpwood are required for the daily production of pulp. With an operational average of 160 m^3 of pulpwood per hectare, the pulp mill requires the daily harvest of about 25 hectares.

Jari has successfully marketed melina pulp under the trade name "JariPulp", obtaining above average prices. Unfortunately, the Jari plantations cannot meet the wood demands of the pulp mill. The pulpwood shortfall is expected to last until 1983, when large-scale harvesting of eucalypt plantations will begin.

Melina is a fast-growing pulpwood tree on good to excellent soils. Because of poor or negligible growth of melina on the poorer soils, the current pulpwood shortage was predicted several years ago. Pine plantations are not solving the current pulpwood shortage because of pine's much slower growth rate (11 years for pulpwood versus six for melina). Jari foresters have classified plantation sites

on a scale of 7 to 31, which is an index of expected height, in meters, of melina trees at ten years of age. The site index is based primarily on soil nutrient status; hence the most fertile sites are expected to produce the best melina.

Most of the plantations in the Munguba/Monte Dourado/Planalto areas are on poor, sandy soils (site index less than 16) unsuitable for melina. These were the sites of the early melina failures that precipitated commercial planting of pine starting in 1973 (on site indices less than 13). The prevalence of poor sites within a 30 km radius of the pulpmill seems to be exasperating for Jari Management. The selection of a fast-growing eucalypt to replace melina on intermediate sites appears to be a risky attempt to increase productivity near the pulp mill. Jari policy is to convert the intermediate sites (site index 13 to 20) to eucalypt after harvesting the melina (see a later section for an analysis of the conversion to eucalypt plantations). Jari plans to harvest eucalypt pulpwood in four years, thus the rapid conversion to eucalypt (15,000 ha planted since 1979) is expected to alleviate the pulpwood shortage in 1983.

The mixing of native woods with melina has progressed to where slightly more than 100 native tree species are now accepted in the pulp mill (Nilo da Silva, pers. comm.). Pulp mill personnel say they can accept up to 20% by volume of non-melina wood without jeopardizing the product--JariPulp sold as 100% melina. Current mixtures are reported to contain 13-22% non-melina wood.

I was surprised to see all the Cecropia trees left after harvesting, since early Jari tests indicated it could be included as melina pulp. Robin told us the relatively long time (6-10 weeks) in moving pulpwood from the plantation to the pulp mill caused the Cecropia logs to become so dry it was impossible to debark the logs and the wood shredded rather than chipped. At the pulp mill we learned Cecropia logs had been used occasionally to sabotage the chipper. In successful attempts to earn overtime pay, some operators of the chipping machine placed metal rods inside hollow Cecropia logs to damage the chipping blades. After shutdown for repairs, the chipper would have to be run overtime to catch up on the supply of wood chips.

I am disappointed Jari has not used more native woods to meet the current pulpwood shortage. Jari's reticence to exceed 20% non-melina wood seems overly conservative in view of the technology to use virtually all woods in a tropical forest (see GSH-3). Heavier reliance on the native forest would probably be less risky than the massive conversion to eucalypt.

Approximately 3,000 hectares of native forest is harvested annually for saw timber, pulpwood and fuelwood. The wood-fueled boilers generating steam for electricity require 1,500-1,700 tons of wood fuel per day. As the distance increases to native forest, Jari expects the eucalypt plantations to also supply the fuelwood.

Conversion to Eucalypt

According to Robin Collins, Jari's 105,000 hectares of tree plantations consist of about 45% melina, 41% pine and 15% eucalypt. (It was 67% melina and 33% pine in 1979.) Management's goal is to reduce the area in melina to 25-30% of total plantations; the intermediate sites are converted to eucalypt after harvesting melina. Current policy of species assignment based on melina site index (see top p. 6) is pine on site index less than 13; eucalypt on site index 13 to 19; and melina on site index of 20 or higher.

The selection of eucalypt (*Eucalyptus deglupta* from the tropical Far East) to replace melina on intermediate sites was dictated largely by the voracious demands of pulpwood for the pulp mill. *E. deglupta* pulp makes acceptable paper, but it does not command the price of melina pulp. *E. deglupta* was obviously selected because of its suitability for the humid tropics and its phenomenal growth potential--Jari expects to harvest eucalypt pulpwood in four years (versus 6 for melina and 11 for pine).

We were particularly interested in observing the changeover to eucalypt, so Robin and his staff showed us the entire spectrum from the oldest to youngest eucalypt plantations on a variety of sites. Although the 1½ year old eucalypt plantations have impressive height growth, there is considerable heterogeneity in stand height. Close inspection shows patches (100-500 m^2) of shorter trees; however, we were unable to determine the cause of height differences. In a 5-month old plantation on poor, sandy soil we saw a few exceptional eucalypts nearly two meters tall surrounded by poorly-growing eucalypts mostly less than 50 cm tall (Figure 6). To the north on a good site, we saw an exceptional plantation with most eucalypt trees 2-3 m tall in only six months. A combination of good site (it appeared to me to be suitable for melina) and a very hot fire appeared to have gotten the eucalypts off to an impressive start. As my colleague Jack Ewel put it: The excellent burn thoroughly scarified a good site, permitting a strong pioneer tree like *E. deglupta* to become well-established. The weak competitive ability of *E. deglupta* requires considerable site preparation in order to get the seedlings off to a head start before competitors arrive or resprout. In the harvested melina stands, the remaining trees and brush must be cut down, allowed to dry, then burned in a hot fire. As suggested above, a hot fire is critical to getting good establishment of a eucalypt plantation.

Company policies to convert to eucalypt and to drastically reduce the labor force have caused operational problems. The labor force is simply inadequate to manually prepare the thousands of hectares for planting eucalypts. Jari's solution is to do more mechanical site preparation. Some methods that have been tried include: (1) After melina harvest, bulldozers literally knock down any remaining trees and brush; the debris is then allowed to dry before burning; the burned debris is then raked into windrows prior to planting. (2) In fairly open melina stands following harvesting, a bulldozer with front-mounted rake clears alternate strips; a row of eucalypts is manually planted in each bulldozer track.

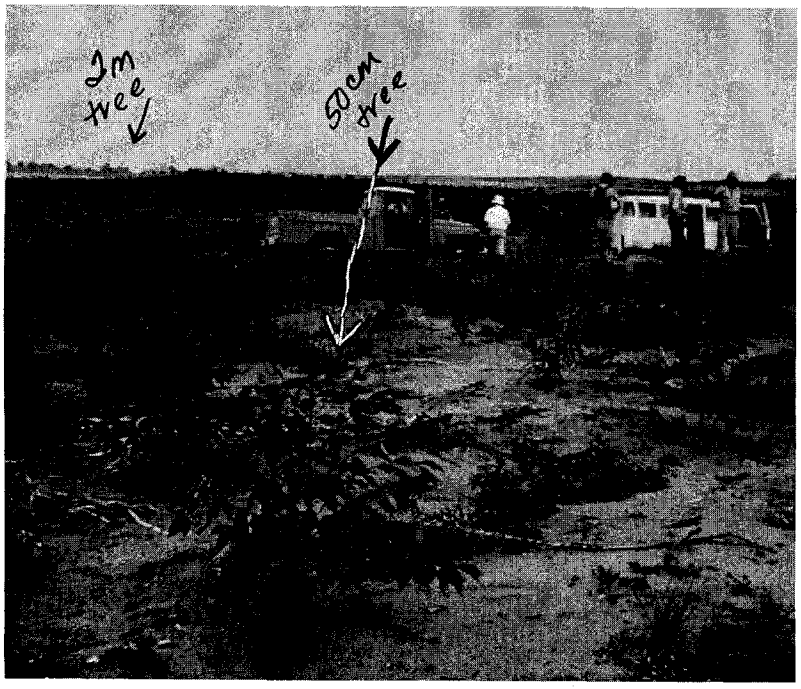


Figure 6. Five-month old eucalypts on sandy soil, about 50 cm tall in this area with scattered trees two meters tall.

Figure 7. Jari's tree nursery at Sao Miguel that will produce 20-25 million eucalypt seedlings for the 1982 planting season.

In alternately cleared strips eucalypt establishment has been poor and growth has been slow. In a recently converted plantation on rolling hills we noticed the eucalypt seedlings had been planted in the subsoil exposed in the bulldozer strip. Without topsoil, it is not surprising the eucalypt seedlings have stagnated. Even on fairly level land cleared in alternate strips the eucalypt plantations are not growing as well as on similar sites prepared manually.

Complete site preparation is now preferred by Jari management because large areas can be cleared mechanically and the removal of stumps and logs will permit mechanized brush control in the young eucalypt plantations. We inspected a 300 hectare test area where all the burned debris and stumps were raked into windrows, followed by separate plantation establishment of pine and eucalypt. The tree seedlings had only been out-planted about three months earlier so it was difficult to predict future growth. Quite frankly, we were surprised to find Jari returning to a complete site preparation operation, after the same procedure had been tried and rejected during Jari's initial attempts to establish melina plantations. The bulldozers that knocked down the native forest and pushed it into windrows for burning also stripped the poor sandy soil of topsoil; without the nutrients held in the topsoil, the planted melina failed to grow. In 1973, Jari started planting less-demanding but slower growing pine on the poorest sites unsuitable for melina.

Robin thinks that the bulldozer-mounted rake strips less topsoil than the standard solid blade; however, we noticed that appreciable soil still ends up in the windrows. Even if appreciable topsoil sifts through the rake's tines, the soil is severely disturbed by the raking operation. Removal of stumps and the churning of soil probably destroys most of the existing root systems, hence only the planted eucalypt trees can absorb the nutrients left in the soil. The key question is can the eucalypts grow fast enough to capture the nutrients before the next rainy season further impoverishes the site by leaching available nutrients out of the root zone?

It is important to recall that virtually all of the eucalypt plantations are being established on intermediate sites following harvest of melina. Many of those melina stands were relatively poor in structure and volume, thus the trees may not have accumulated appreciable stockpiles of nutrients prior to harvesting. Robin showed me some 6-18 month old second rotation melina plantations that were already showing serious stagnation (i.e. lack of growth). It is probable that the initial growth spurt exhausts the small reserve of nutrients and continued growth is impossible without fertilization. It should be clear that complete preparation of intermediate sites may exacerbate the nutrient limitations to tree growth.

I am convinced that pine rather than eucalypt is the tree to plant on the sandy intermediate sites (Figure 8). In contrast to the shallow-rooted eucalypt, pine develops a deep taproot that can exploit a greater soil volume. As mentioned earlier, choice of eucalypt was largely dictated by the pulpwood shortage at the mill. But it seems that Jari management is ignoring earlier ecological lessons as well as current knowledge of nutrient cycles in the efforts to meet short-term demands. Failure of the eucalypt plantations would probably cause an indefinite shut-down of the pulp mill and of Jari. Success of the eucalypts, on the other hand, would undoubtedly increase the wealth of whoever owns Jari in five years.

Figure 8. Pine plantation, 36 months old, on sandy site. Stake ca. 30 cm tall.

Beiradão

Early on our last morning in Jari we squeezed is a brief visit to Beiradão, the "instant" shantytown that sprang forth on the east bank of the Río Jari. Most foreign-press articles about Jari typically characterize Beiradão as a prostitution slum for the early Jari employees. Beiradão is a linear town, mostly one row of houses on stilts, extending for several kilometers between Monte Dourado and Munguba. Across the river from Monte Dourado, Beiradão has developed 3-5 additional rows of buildings.

Our 7 a.m. stroll along the Beiradão boardwalk, the main "street", was delightful as shops opened, school started and the slaughterhouse finished butchering. We were surprised by the array of goods on display (automobile steering wheels, refrigerators, designer jeans and stereo systems to medical and medicinal products including occult herbs and bark). Our Jari host informed us that the Beiradão telecommunications office provides excellent microwave telephone service even to the USA.

We were impressed by the bustling, prosperous air of Beiradão. Noisy generators provide electricity and public taps dispense water. People carry on much as they do in a market place of any Latin city. Dogs and crawling babies had no trouble maneuvering on the boardwalk with missing and shaky planking. Obviously, many of the previously employed laborers at Jari have decided to live in Beiradão. Boat taxis are fast and inexpensive between Monte Dourado and Beiradão. The Beiradão folk obviously count on emergency medical facilities at Monte Dourado, and the young people from Jari count on the bars and dance halls to provide entertainment and recreation.

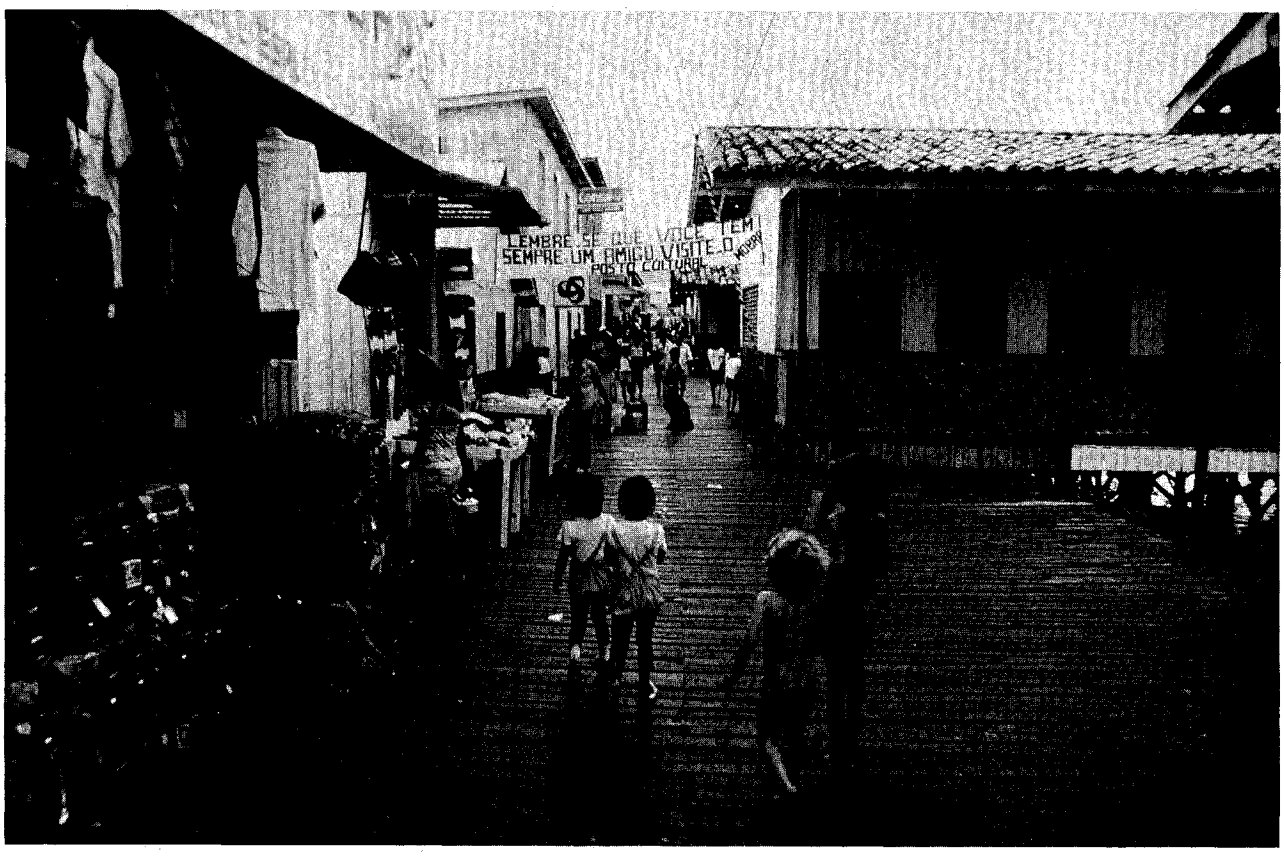


Figure 9. Main street in the bustling town of Beiradão, located on the east bank of the Río Jari, across from MonteDourado. View of schoolhouse on right; children had just happily entered the building.

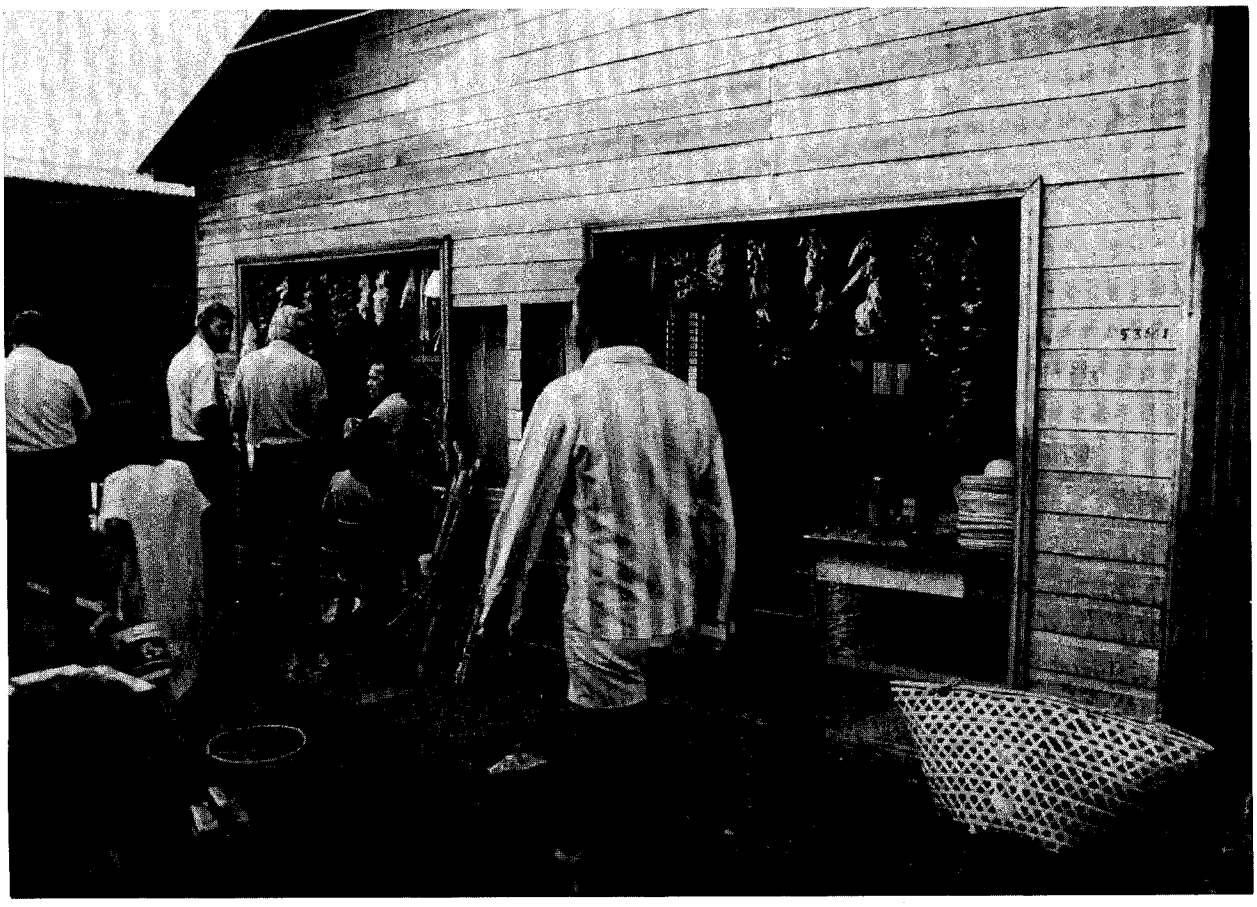


Figure 10. View of an entrepreneur with spices, herbs, native wares and produce. At right, basket containing two live ducks. Bottom left, water buckets.

Sincerely,

Gary

Gary S. Hartshorn
Forest & Man Fellow

Received in Hanover 11/23/81