

FMF-4

Amazônia: The Domain of Water

Belém, Pará

Brazil

31 August 1967

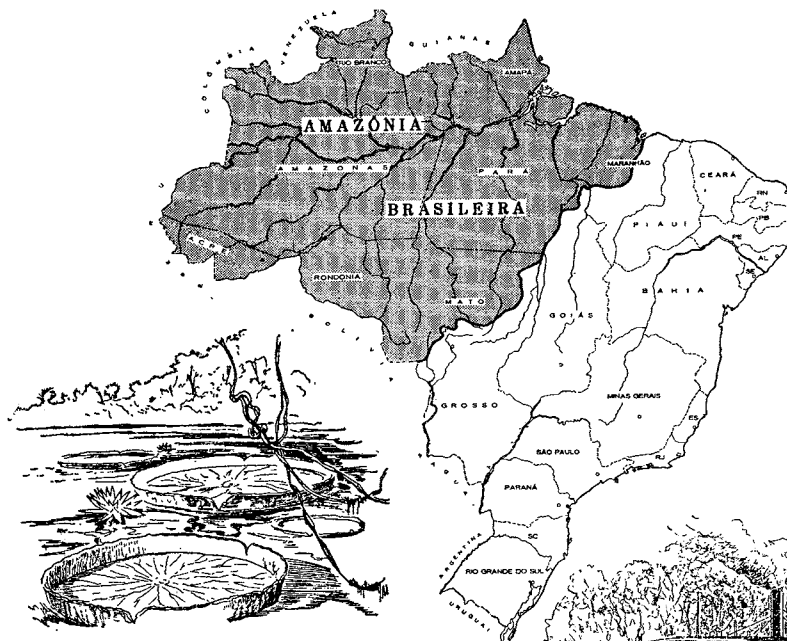
Mr. Richard H. Nolte  
Institute of Current World Affairs  
366 Madison Avenue  
New York, New York 10017

Dear Mr. Nolte:

In the beginning it was a great inland sea, opening westward to the Pacific. Around it arched a massive cordillera which today, worn down by time, forms the Brazilian plateau to the south and the Guiana highlands to the north. That was Amazônia in the Paleozoic age.

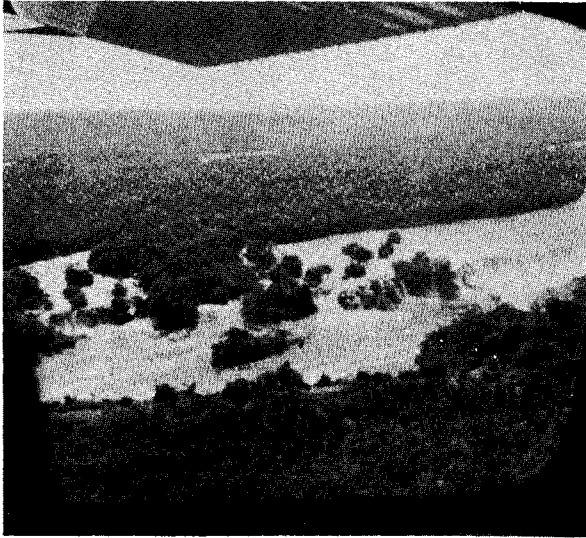
Then tectonic forces broke the ocean floor, heaving up the crust to form the Andes. The sea became a lake, its waters turning sweet, the marine creatures succumbing or adapting to the change. Mollusks left deposits of shells as vestiges of their pre-historic presence. Extensive salt beds, recently discovered during oil explorations near Nova Olinda, suggest the all-encompassing body of water. Survival capabilities of certain fauna preserved their species until today; rayfish still inhabit the fresh waters as do giant sea turtles and certain crustaceans normally found in saltwater environments. Behemoths among the fish, such as the pirarucu weighing several hundred pounds, indicate an ancestry tabulated in milleniums.

BELOW. Amazônia covers about 60% of Brazil. It includes the states of Pará, Amazonas, and Acre—the territories of Rondônia, Amapá and Roraima—and parts of the states of Mato Grosso, Goiás and Maranhão.



Vitória-régia

Gaiola



ABOVE. On the left, the first falls of the Jarí River which forms the boundary between Pará and Amapá in Lower Amazônia. On the right, the floodplain of the Amazon River in August when the water has begun to recede, but still stretches to the horizon in all directions.

Little by little, erosion or, possibly, glacial flooding opened a new route to the ocean---this time eastward to the Atlantic. The sedimentary basin formed by the great lake is today the center of the continent where the rivers---Negro, Madeira, Purus, Juruá, etc.---run deep and far with little gradient before they are cut by falls and rapids in their upper reaches. In contrast, the tributaries of the lower Amazon---Xingú, Tocantins, Tapajós, Trombetas, Paru, Jarí---are navigable only short distances from their mouths before cataracts scar their beds. According to geologists, this latter topography resulted from the mountainous isthmus which once divided lake from ocean.

Amazônia is not one vast swamp, but rather a low Tertiary plateau of gentle relief, interlaced and inundated by a welter of water formations. Louis Agassiz said of it:

"This labyrinth of water is more an ocean of fresh water, cut and divided by the land, than a fluvial network."

A Harvard scientist I met in Manaus coined his own epithet: "A liquid desert."

This is a land that wants to be water. Amazônia holds one-fifth of the world's available fresh water, the volume of the Amazon River varying between 60 and 140 thousand cubic meters per second, depending on the season. At the gorge of Óbidos it reaches a depth of 425 ft. and at its mouth, a width of 125 miles. Seven times the size of France, the Basin has over 10,000 navigable miles in its major rivers alone, 17 of which are longer than the Rhine.

The catchment area, embracing some 23° of latitude and 30° of longitude, receives from two directions. To the west the headwaters reach into the ice and snow of the Andes which feed it with its thaws. From the east, more dramatically, come the heavy, dark cumuli which, from November to May, swirl over its length propelled by Atlantic winds. Tropical rains drench the land in spasmodic torrents. The verdant, dense vegetation feeds upon this moisture and upon the shallow organic matter laid down by itself—not upon the soils which are thin, poor and acid. This is winter in Amazônia---temperature, as ever, averaging in the mid-80's; humidity, as ever, 85% or higher; and rains, as in this season, heavy and daily.

In a classic treatise based upon a 1912 journey through Amazônia, the Swiss scientist, Dr. Hans Bluntschli, commented:

"The cycle of water, coming from the sea through the air to the ground covered with forest and returning from the forest via the fluvial plain to the eternal sea---this is the great epic that dominates the image of Amazônia, its life and its character. Perhaps in no other part of the world does the powerful force of the cycle of water present itself, within the mental vision of man, with such clarity and evidence."

In Brazil alone, the basin encompasses some two million square miles, the two hundred tributaries of the Amazonas converging from all directions. The region is so vast that, as I have seen this year, the Rio Madeira from the south is drained in drought and scarred by sand bars while the Negro from the north, disgorging into the Amazonas only a few miles from the Madeira, is swollen with waters which have not been known since 1953, some thirty feet above normal.

The Negro's is the flood that river-dwellers dread. Crops wash out, and houses submerge. Along the Negro this year, Indians living on the banks were forced to flee to highlands, clustering in overcrowded villages which soon turned rife with sewage and bad water. Measles spread as an epidemic among a people with no natural immunity. Fatalities soared. Those returning from the area tell of the few hospitals filled to overflowing, their corridors slung with hammocks laden with the sick. A friend's boat was stopped at night by an Indian in a canoe, holding a lantern. He asked transport for his fevered wife and child to the nearest medical post. Since it was in the opposite direction, 100 miles, they gave him aspirin, and a blessing.

At floodtide the Amazonas reaches a width of 35 miles. Only prominent features of land protrude---levees, points and hummocks, called restingas---which swirl in roughly parallel contours as if a paisley, brown and green. Flying over it, as I did several times at the confluence of the Amazonas-Negro-Madeira, it seems one great, silent dirty sea, set in for undetermined time. Here and there aquatic pastures of canarana grass suggest terra firme, but the roof spine of a house, barely breaking the surface, indicates more accurately the depth of the waters.

But the eye can deceive and perhaps it is not solid land at all, but a floating island, terra caída, which breaks away from the shore, sometimes ripping off many square kilometers to float hundreds of miles down the river before disintegrating and settling once more as soilbed in a completely different part of the Basin. These ephemeral islands can support tall tress---the sumaúma (ceiba) and faveiro---still upright in their river journey---or livestock, and even homes and humans.

Exuding moisture at all times, the Rio-Mar, as the Amazonas is often called, repeats itself above earth's surface in a sinuous trail of low clouds which gravitate above it. From horizon to horizon in early morning, hyperhumidity creates a tufted vapor punctuated by tree crowns, an hallucinogenic effect of a world turned upside down. Water and its essence spread over the land, hover above the surface and hang heavy in the sky.

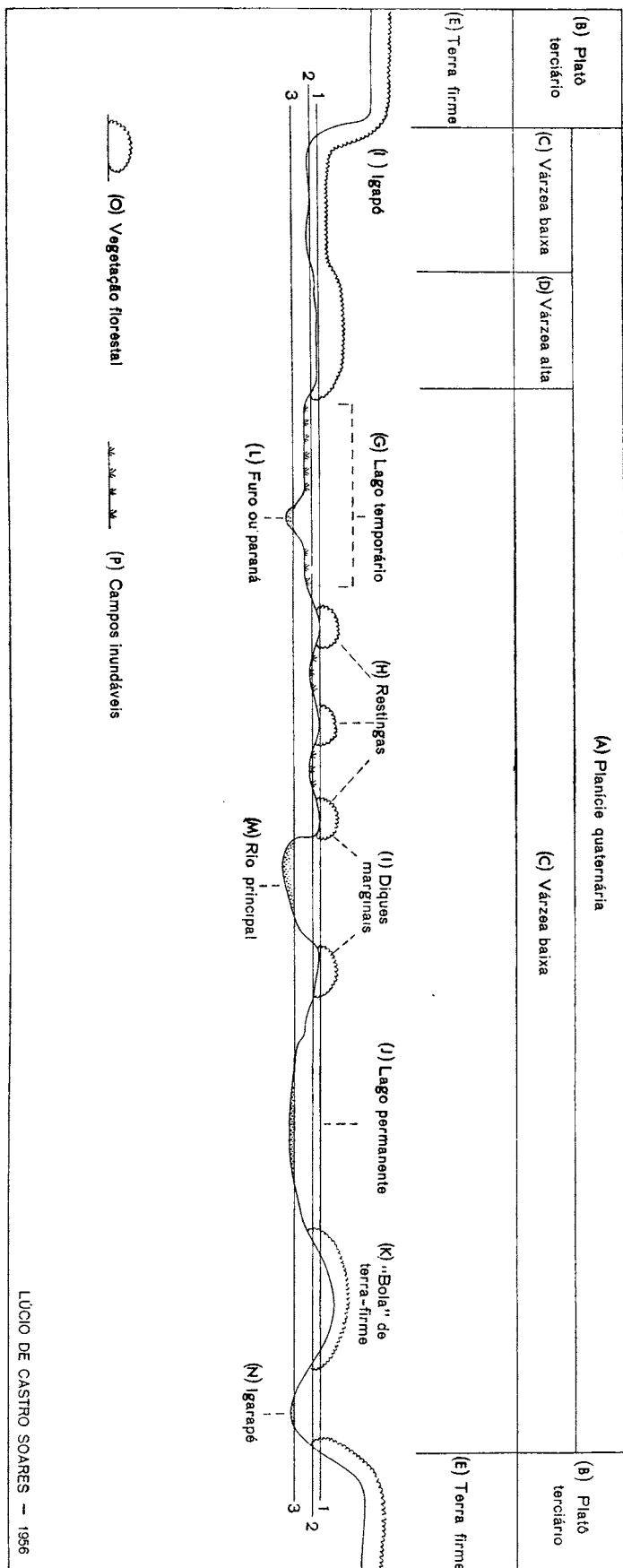
The liquid labyrinth below demands a high sophistication to comprehend and then identify. Credit goes to the Indian for this knowledge. His language may be void of modern scientific terms but it is rich in what concerns him: igapó, igarapé, caa-igapó, paraná, caatinga. Each word denotes some nuance of difference between one body of water or vegetation and another. Overlaid with Portuguese, the philology of Amazônia reveals its way of life.

To suggest the variety of water-oriented formations: igapó is an area of dense vegetation continually under water; caa-igapó, vegetation associated with moisture-laden soils; várzea, floodplain inundated a part of each year; igarapé, literally a canoe trail, is a river amid the forest; paraná, an arm of the river forming a large island; furo, a stream connecting two rivers or other bodies of water; sacado, a lake shaped like a half-moon, resulting when a river changes its course; rego, a small channel within a depression; caa-tinga, an open forested area (different meaning in Northeast Brazil); terra firme, high land seldom flooded.

The cycle of water sets the pace of life throughout the great Basin, but reveals itself most abruptly in the Amazonas estuary. Here, intricate ramifications of the river cut the land into baroque pieces adjacent but askew like an unworked crossword puzzle. To the north the Ilha Caviana guards the main channel which runs past the Ilha Grande de Gurupá. Below the Ilha de Marajó (the size of Switzerland), the south channel is formed largely by the waters of the Tocantins and Guamã Rivers and is called the Bay of Marajó or Pará River.

Along this southern periphery clusters the highest population density of Amazônia, centered on Belém. Therefore, ships are normally obliged to call at its port and then wend their way up to the main channel via the Furos de Breves. So narrow the trees sometimes brush the hulls of the ocean freighters, this meander divides the Marajó from the mainland. From the outer reaches of the complex Amazonas, captains stand aside for pilots, always Brazilian, who exert not only knowledge, but also instinct to skirt the constantly shifting shoals, sand bars and floating obstacles.

The Rio-Mar and the ocean interact with vigor. In the dry season.



IDEALIZED CROSS SECTION OF THE AMAZON FLOODPLAIN, SHOWING THE PRINCIPAL ELEMENTS OF ITS DRAINAGE, RELIEF, AND VEGETATION:  
A) Quaternary plain; B) Tertiary Plateau; C) low floodplain; D) high floodplain; E) terra-firme; F) igarapé; G) temporary lake; H) "restingas"; I) levee; J) permanent lake; K) "bola" de terra-firme; L) Furo or paranã; M) main river; N) Igarapé; O) forest vegetation; P) flooded grassland. LEVELS OF THE MAIN RIVER: 1) high flood level; 2) normal flood level; 3) normal low water level.

August to November, the fresh waters recede and the tides dominate, their effect felt even beyond the Tapajós and in the tributaries. Vila Franca is an example; located on the Rio Arapiuns some 25 miles from the Amazonas and over 400 miles from the ocean, the town experiences as much as 1 1/2 ft. fluctuation every day.

On the other hand, the tremendous volume of river water discharged into the sea---140,000 cubic meters per second in the rainy season---causes a tidal phenomenon called the pororoca. Feared by small craft, a great swell surges erratically from the ocean, exhausting its momentum far up the river.

Suspended between two liquid goliaths, the archipelago of the estuary is product of their impositions. The maritime shores are fringed with mangrove and aninga. Along the river banks, the asai palm, worthy of the Japanese silk-screen, propagates in clusters of delicate, violet-colored stems overhung by subtle fronds. The majestic fans of the mirití palms top tall grey trunks, alongside the heavy-crowned babaçu palm laden with oleaginous nuts.

Flying over the east-west length of the Marajó in a Cessna 185, I could see the varied mantle of this sedimentary island. The eastern end is a swampy savannah where at least 50% of Amazonia's cattle-raising takes place. The native breed is called pé-duro, referring to the resistance of its hoofs to constant immersion. Now, water buffalo and Zebu are being introduced. Though the stock may thrive on the natural pasture most of the year, entire herds may be wiped out in flood season. As the waters rise, the animals retreat to the knolls and are confined on plots inadequate for forage. Enclosed in flooded corrals or on floating rafts called marombas, they are fed with canarana grass, cut from canoes by the ranch hands.

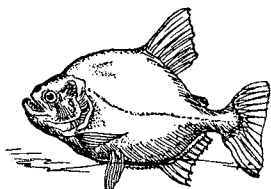
The western end of Marajó, being higher, supports arboreal vegetation. Along the furos and igarapés which shred its surface can be seen small outposts---modest sawmills fronted by floating logyards, and depots to buy the piecemeal extractive products of the natives---largely gums and nuts. As we pass over the Furos de Breves, a white freighter rounds a tight bend above the town of Antonio Lemos. We continue westward over the Amazonas and the tip of the Ilha Grande de Gurupá to the Jarí River.

Just as cattle-raising is dominated by the flux of waters, so are fishing and hunting. Cattle must retreat from rising tides and so must wild game. Knowing this, the aborigine or caboçlo paddles his canoe to a likely haven where spotted jaguars, wild pigs, deer, alligators and other animals with valuable skins abound. Entrapped, the game is easy prey.

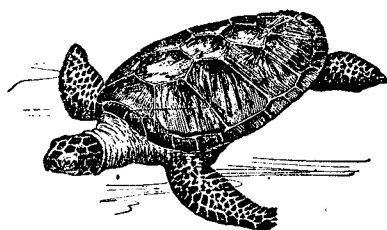
In contrast, fishing is at its best in the dry season. Agassiz's estimate of 2000 ichthyological families has not yet been refuted. Among the prize catches are the small and beautiful tucunaré and the giant



1.



2.



3.



4.

pirarucu brought in by harpoon. In centuries past it was the manatee, a plant-eating mammal now practically extinct; it was pursued not only for its meat, which filled two ships bound for Europe every month during the 17th century, but also for its hide. Another victim of man's zeal has been the giant tortoise whose shell has many ornamental uses and whose meat is a regional delicacy, served in such dishes as sarapatel and pachicá. In the dry season, when the ocean dominates the ebbing river, the large market in Belém offers an abundance of crabs, clams and oysters.

Less desirable aquatic life also abounds. The infamous piranha is a small flat fish whose teeth are much respected. Another ugly sliver of a fish, the candiru, searches out an orifice and attaches itself. And, the electric eel is common in Amazon waters.

While most agriculture of Amazônia is concentrated on the floodplain and is inexorably governed by the cycle of the waters, even the extractive activities of the terra firme change with the seasons. A typical caboclo of the interior is likely to tend about a hundred rubber trees along a jungle trail during the dry months. But the latex, which drips into small open cups, is spoiled by water, so with the rains, the caboclo must change his means of livelihood. Often the switch is to Brazil nuts which are freed from the high branches of the castanheira by the storms of the wet season.

Another major extractive industry of the region, lumbering, has its seasonal rhythm. The cutting takes place year round, but the logs must be rolled from the terra firme to the rivers, and if the low-lying várzea between is flooded, then transport is impaired. On the other hand, high water is the time for floating the logs down to the sawmill, especially when shoals and rapids must be passed. Also, the logging camps and, for that matter, all population clusters upriver must stock a year's provisions during the months when the boats can reach them.

1. Candiru

2. Piranha

3. Turtle

4. Manatee

The very population pattern of Amazônia is determined by the water courses. Myriad metaphors have been coined to describe the hydrographic network of the region. A popular one is that of a tree ---the Amazonas as a trunk, the tributaries as branches, and the complex delta area as the root system. In this case, people are the leaves and lichen which cling to branch and trunk. The rural inhabitants scatter themselves in isolation along the river banks. Then, there are nodules, tucked like epiphytes where trunk and branch join ---these are the cities.

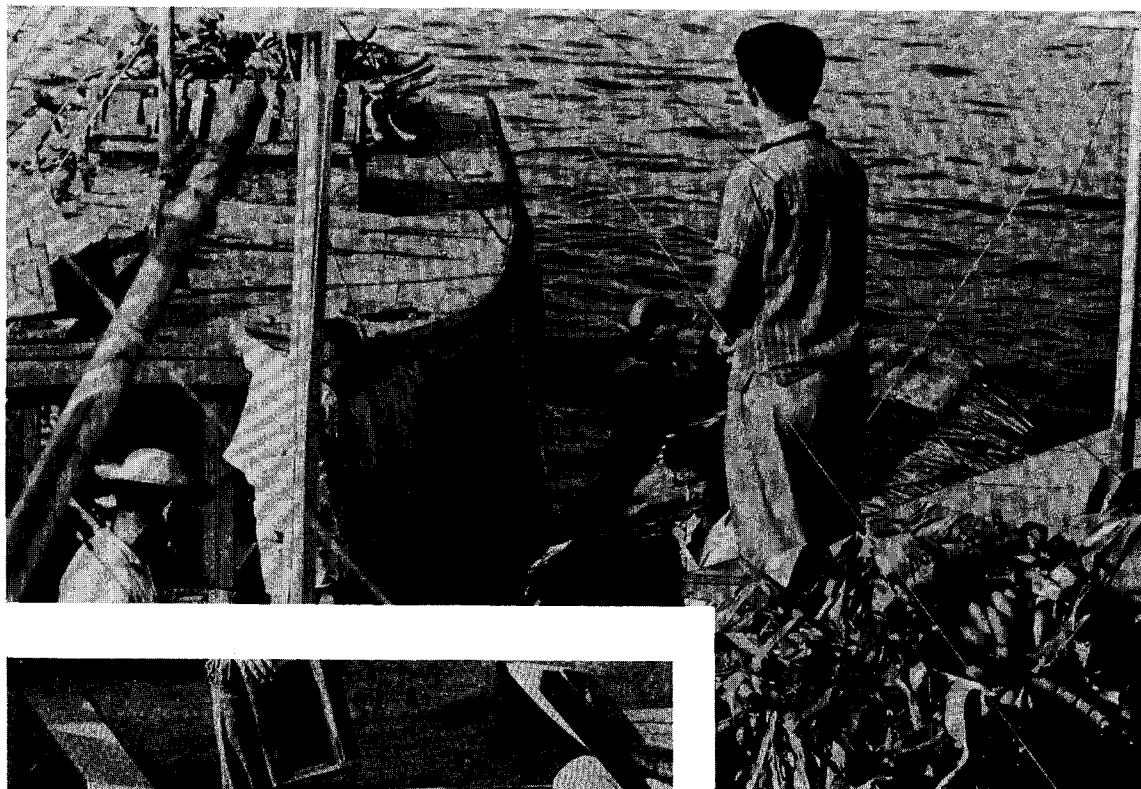
Manáus, second city of the region, originated as a fort in the 17th century, strategically located on the Rio Negro and known then as Vila do Lugar da Barra, i.e., village near the mouth of the river. The city flourished in the late 19th and early 20th centuries because it was so located as to garner the extractive products of the major rivers of Middle Amazônia. Its position at the hub of this fluvial network determined its existence. Barcelos, up the Negro, was designated previously as primate city of the area, but it could not withstand the centrifugal pull of the center of confluence and today stands as a mediocre trading center in the hinterland.

Likewise, Vila Franca on the Tapajós was chosen, *deus ex machina*, by the Jesuits in colonial times as the center for regional civilization. By the 18th century, they supervised 10,000 Indians practicing agriculture and craftwork in and around this early metropolis. At that time Santarém was but a scattering of huts. However, in that century the Marquês de Pombal expelled the Jesuits, and the town was reduced to its own resources for survival. It was at the confluence of the Arapuins and the Tapajós, but this apparent advantage was obviated by its location on the northwest side of the vast Bay of the Tapajós, exposed to the wind and the storms driven from east to west into its unprotected harbor and shores. River commerce preferred the safer and more convenient quais of Santarém. Vila Franca dwindled and was absorbed within Santarém's jurisdiction.

This dendritic demographic pattern is explained by one simple fact: o rio é a rua---the river is the road. Therefore, as regional say has it: "the boat is the horse; the oar is the bridle."

The boats in Amazônia come in a proliferation of sizes and styles to serve all purposes from hunter to entrepreneur. Indigenous is the igarité, a pirogue appropriate for igarapé and igapó. The caboclo enlarged the shell and put in seats to make the montaria; generally he propels it sitting at the very prow with a hand-carved paddle the shape of a lollipop. Having no keel, it demands a masterful stroke to keep on course.

Middle Amazonas seems to rely more on motor than on sail for its locomotion. Gaiolas abound in all sizes, so called because their superstructure of one or two levels has the appearance of a cage. The large public market sets on the river's edge and throughout the morning is a hub-bub of boats unloading produce for the stands, in Manáus.



The market in Manáus.  
 ABOVE. Unloading bananas.  
 LEFT. In the closest boat, piassava fiber for brooms; in the center boat, grapefruit; behind, pineapple, grapefruit and papaya.

Today the largest gaiolas along the Amazon belong to SNAPP, the government line which services the entire Basin, carrying passengers and freight at a fraction of the real cost. On the upper deck are the more luxurious quarters, with private cabins. On the lower, just above the water, are the second and third classes where passengers provide their own hammocks and food. The open area aft becomes a maze of overlapping hammocks---families and strangers suspended side by side.

From Santarém downstream to Belém, reliance is more upon the sail. As in Manaus, the market of Belém, called Ver-o-Peso (Watch the Weight), is adjacent to the water. The one-masted sailboats, vigilengas, bring in the fruits and fish and vegetables, and crowd against one another in the protected harbor. By early morning, the tide is out and they sit upon the putrescent bed of mud where vultures quarrel over the debris.

The giants of the Amazon are the ocean-going freighters, particularly those of the Booth Line, the one international shipping company that penetrates beyond Belém. Based in Liverpool and New York, 14 ships ply the Atlantic, Caribbean and Amazon. Iquitos in Perú is the terminal point, reached only by the smaller ships in August, September and October when the allowable draft is 16'---by the larger ones in the wet months which increase the safe draft to 27'.

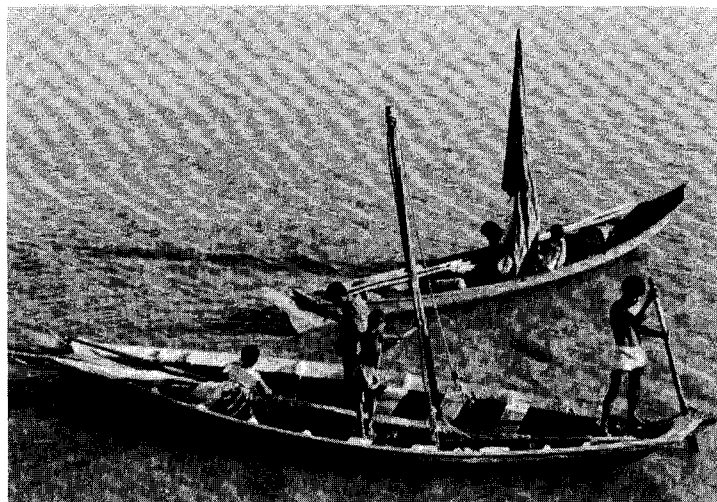
Booth, along with many other English companies, first came to the Amazon because of rubber, in the late 19th century. Now the freight is very different. The largest cargos come in April, May and June when the harvesting of Brazil nuts reaches its peak, and the waters allow heavy loads.

The "Clement" and the "Benedict" visited Manaus during my time there. Their officers were very British, garbed in ballooning white Bermuda shorts and white shirts open at the neck, and drinking Scotch. The crews were West Indian, because of company policy, though the Captain freely stated his preference for Brazilian hands.

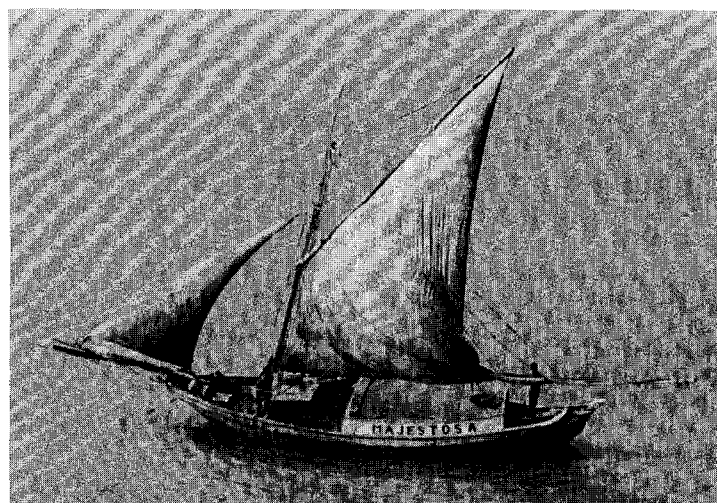
Incoming cargo, as can be expected, was largely machinery---to mount a jute-processing factory and a refrigeration plant.

The "Benedict's" manifest of cargo taken on in Manaus gives a good idea of the region's economy:

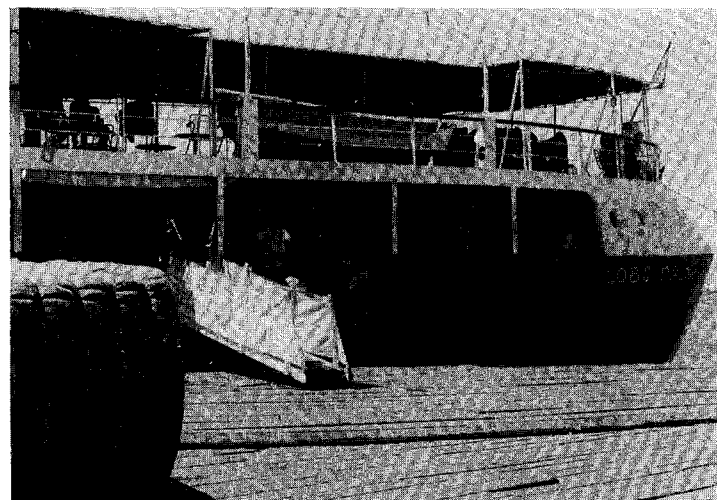
To Hull, Bulk nuts	- 50 T.
To Avonmouth, Bulk nuts	- 175 T.
To Liverpool, Shelled nuts	- 67 T.
To London, Bagged nuts	- 71 T.
To London, Roseoil	- 22 drums
To Havre, Dry skins	- 56 bales
To Havre, Roseoil	- 5 drums
To Rotterdam, Roseoil	- 3 drums
To Rotterdam, Dry skins	- 250 bales
To Riga (USSR) via	
Rotterdam, Roseoil	- 30 drums
To Marseilles, Roseoil	- 9 drums
Total	- 403 T.



Montarias with  
sail in the Bay  
of Marajó.



A vigilenga  
makes sail after  
unloading its  
cargo at the  
Belém market.



A SNAPP gaiola  
docked at Santarém.  
On the lower deck,  
a crosshatch of  
hammocks.

Down river at Itacoatiara, the "Benedict" would take on an additional 50 tons of bulk nuts. This was in August so that the Brazil nuts did not dominate as they would by May when they tend to supplant most other shipments. A lumber executive complained to me that Booth had no space for his veneers when the harvest season was on.

The "Clement's" cargo was more varied, in addition to roseoil and skins including: sorva and massaranduba (gums from trees), balata (a type of rubber used particularly for golf balls), balsom copaiba (a medicinal oil), and cocoa beans.

Not in the cargos of the "Benedict" or the "Clement", but major exports from Manaus are jute and rubber. Brazilian freighters tend to carry these to the south, to Rio and Santos, where they are utilized in national industries. In return their holds arrive filled with sugar, beer, rice and flour.

Pound for pound, the most valuable cargo is the roseoil, base for fragrant soaps and perfumes. One drum is worth \$1000; freight charge to Europe is \$55.

A significant cargo I saw aboard the "Atalhuapa" was automobiles. This Booth ship, now chartered by a Peruvian line, was headed to Iquitos with its hold packed to capacity and its deck an impassable checkerboard of Fords and Chevrolets. Since Iquitos is a small town and Perú has tight restrictions on the import of motor vehicles, one can only presume some loophole in the customs ring.

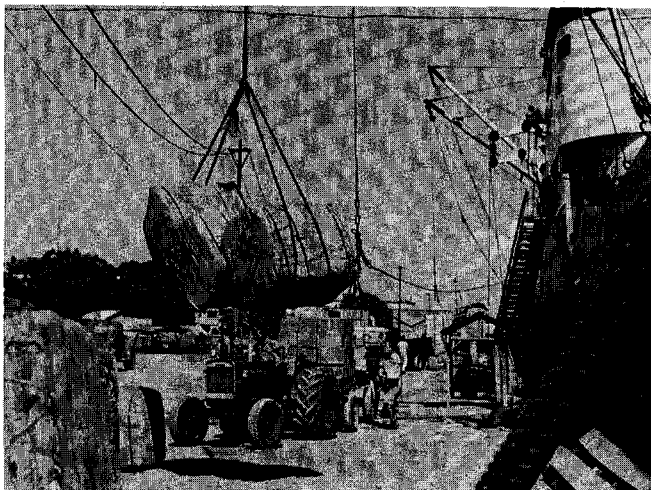
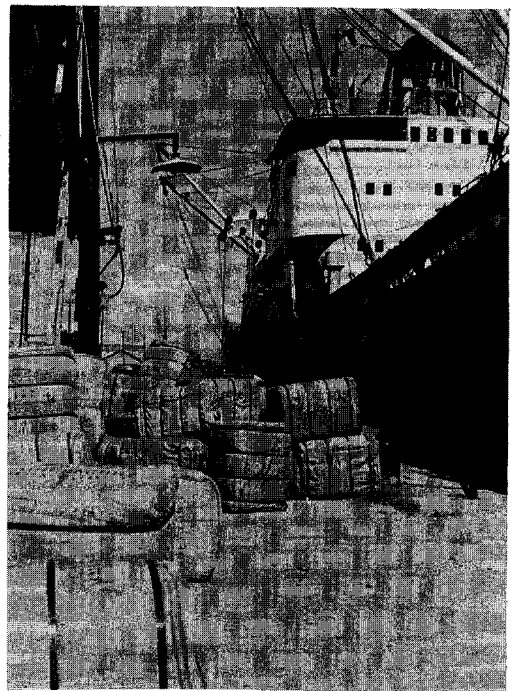
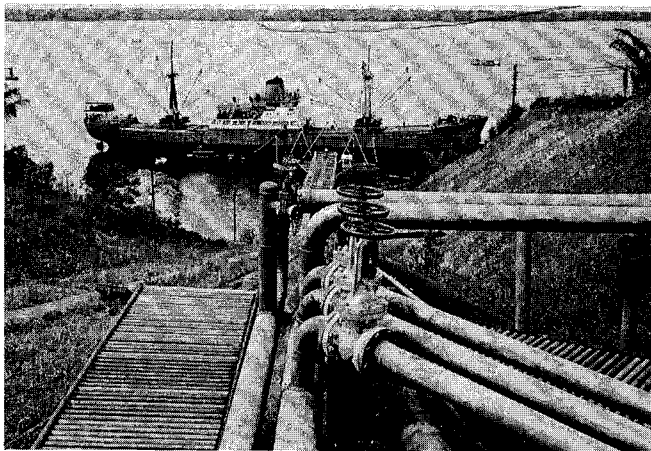
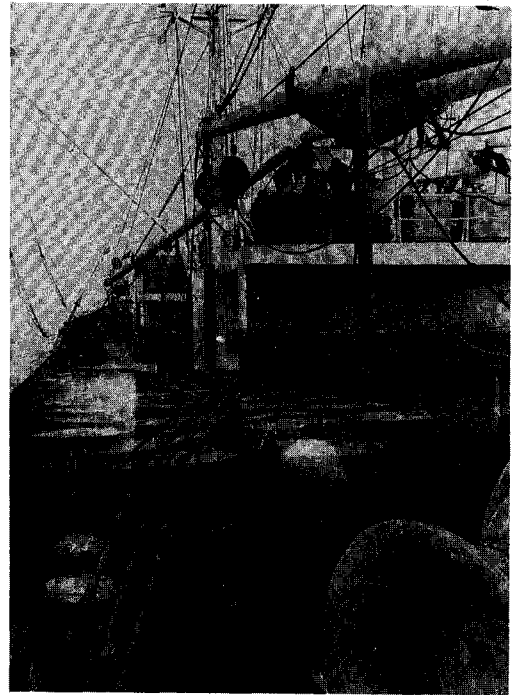
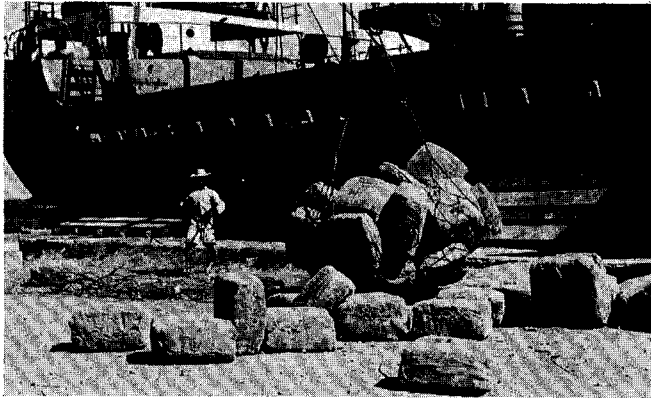
There are many complaints about the high cost of river transport in Amazônia, although by U.S. standards they seem low. The "Clement", a ship of 25,000 tons, docked in Manaus for 24 hours, unloading 150 T. and taking on 250 T. The port charges, including taxes and the use of facilities, came to approximately \$450.

Base pay for stevedores for a 10-hour day, 7 a.m. to 5 p.m., is Cr.\$5000, or \$1.85---that's for the whole day, not per hour. They can increase this to \$11.10 if the 10 hours is at night, more than 100,000 T. are loaded, and there is a 100% bonus for doing a good job.

The docks of Manaus, built in 1902, are one of the engineering feats of the world. Since the water level of the Rio Negro fluctuates as much as 40 ft., the wharves are set on large floating tanks in series. The whole is stabilized by heavy chains, one set from the outer edge of the docks in to the shore, the other from the inner side out to moorings. The chains are adjusted with the changing water level.

Consisting of two sections, one is shaped as a "T" with the base on shore. The vertical forms a "roadway" with pedestrian walkways alongside a narrow gauge track bearing small pushcarts for transporting cargo.

The other dock floats free from shore and services larger ships by means of overhead cables attached to towers. Ship design at the time of the docks' construction allowed direct access to the hold from the towers. However, design has changed and the towers, now obsolete, will soon be dismantled.



On the left, from top to bottom. The Brazilian freighter, Waldemar Pinheiro, a) loading rubber, b) refueling at the one oil refinery in Amazonia, and c) loading jute. On the right, above, drums of roseoil; below, jute bales ready to be loaded.

Built and managed by a British company, the docks were taken over by the Brazilian government in 1963. An Englishman told me it was because the company was not allowed by the government to raise its charges, regardless of rampant inflation, and therefore could not afford the costs of the operation; a Brazilian told me it was because the company drained off all the profits and made no attempt to maintain the facilities.

On the outer side of the docks the depth this August was 140 ft. Such profundity at the mouth of Amazonian rivers is common; the Tapajós plumbs 260 ft. at the confluence. These deep, funnel-like formations are called rias and are explained, geologically, as excavations occurring during the last glacial (Wisconsin) when the sea level dropped 70 to 100 meters below that of today; then the bed of the whole Amazon system cut much deeper. Besides the major ria at the Negro's mouth, five smaller ones pierce the city of Manaus, their waters cluttered with montarias and gaiolas, their steep banks bedecked with ramshackle houses on stilts.

A ria in Manaus with montarias in the foreground and gaiolas in the background.



The Negro also illustrates another phenomenon of the Amazonian domain of water. As its name suggests, the river---though transparent---is the color of a dark tea. It is, therefore, called a "black river". On the other hand, the Amazonas is a "white river", heavily laden with sediment in suspension creating an opaque café au lait color. Flowing into each other, there is a distinct line which marks the confrontation; one can literally put one's finger on the point where the Negro meets the Amazonas.

Throughout its course, the Amazon River---whether it is called Marañon, Solimões or Amazonas---is a "white river", as are the Purus, the Madeira and the Branco. Theirs are the currents which meander, ramify, change their course, sweep away embankments. Their waters thrive with suspended material, with plankton and algae upon which a myriad fish feed. They build up extensive floodplains which they inundate to nourish again each year.

The water of each river tells the story of its journey: its source and the nature of the terrain through which it passes. "White waters" often begin in the mountains and thus are early laden with erosion's washings. This is the case of the Amazonas which, a dominant opinion has it, springs from the snows of the Curenani peak in Perú to form the Vilacanota which is swelled by the Apurimac and Ucayali to become the Solimões at the Brazilian border and then the Amazonas below Manaus. Likewise, the Madeira has an Andean source in Lake Titicaca and the Beni River in Bolivia.

In contrast, the Rio Branco flows from the northeast, rising amid the Guiana highlands. But it does cut through extensive savannah area where it can wash away less protected banks.

"Black rivers" have different characteristics and different life histories. Their course is usually stable with little lateral flooding and erosion, thus creating few floodplains. Their waters are high in humic acid and, perhaps because of this, are poor in fauna and flora, often called "rivers of hunger" by the natives.

On all scores, the Rio Negro is a perfect example of a "black river". Its source is a low-lying peneplain, amid a tropical igapó. High rainfall and temperatures have leached the soil until the minerals are exhausted. The vegetation of the swamp decomposes rapidly, soaking within the headwaters of the river to create an acid content and brown coloration. Although a few of the Negro's tributaries on the west come from the mountains and are "white", far the greater number have their origins in environments similar to the major stream.

Though often called "black", the waters of other clear rivers take on blue or green casts---the Tapajós, Xingú, Juruena, etc. They unusually have stable beds, broken by falls and rapids and lined with sand beaches, but few floodplains.

Throughout Amazônia, the waters have a daily, monthly and yearly rhythm---ebbing and flowing with the tides, flooding and receding with

the rains, quarreling among themselves---black against white, fresh against salt, stagnant against moving. The Basin began as water and is still very much within its domain, a product of forces and counter-forces which operate on a gargantuan scale.

Sincerely yours,

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Map, p. 1; Chart, p. 5: Lúcio de Castro Soares, Amazônia. International Geographical Union, Rio de Janeiro, 1956.

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