After a lifetime in shipping, billionaire Daniel K. Ludwig spends his twilight years, and over $700 million, transforming Amazon jungle into his most ambitious scheme—the Brazilian government permitting.

Ludwig's Amazon empire

By Norman Gall

AN ASTONISHINGLY youthful-looking 81, the billionaire Daniel Keith Ludwig takes all-night plane trips, swims daily and walks, drives and flies around the 15,000 square kilometers (5,800 sq. mi.) of Jari, his plantation in Amazonia that has become a fable of the equatorial forest.

Despite an old and painful back injury, he flies down to Belém from New York or California once or twice a month, then switches to the old DC-3 that takes him and some 27 other passengers to his great plantation. Once he lands, the old man stalks about the plantation to question his managers, insistently and in great detail, about the installation of dikes, canals and pumping stations in the irrigated rice fields; about the planting of trees and their progress in sandy and clayey soils and the problems of pest control; about the construction of roads and the laying of railroad track on which timber will be brought to the $250 million pulp mill (260,000 tons a year) and power plant that are starting up after being floated across the oceans from a Japanese shipyard last year to rest permanently on a system of wooden piles constructed at the edge of the Jari River, a major northern tributary of the Amazon.

This giant undertaking has been published widely, but Ludwig and his project still remain a mystery to many who intensely debate the future of Amazon development. "Jari is the watershed between the contending arguments that the equatorial forest can or cannot be exploited economically on a large scale," said a Brazilian diplomat for Amazon affairs. "Jari is the great test. If it is successful, Jari will open the way for mechanized exploitation of the forest on a scale that, if unrestricted, could threaten the survival of the forest itself."

It seems beyond dispute that a pioneer project of Jari's size could depend only on the will and vision of a single man, since no corporate investment committee or board of directors would ever approve an undertaking so audacious, complex, risky and expensive. While it is one-fifth greater in area than the state of Connecticut, where Jari Forest Products Inc. has its corporate headquarters, it is smaller than any of the Central American republics. The plantation and its satellite communities are now inhabited by

25,000 people. Perhaps only a few hundred lived there before on the rivers.

On this tract of jungle, which Ludwig bought in 1967 for a reported $3 million, he has installed what will soon become the world's largest rice plantation; has replaced more than 100,000 hectares (a hectare equals 2.47 acres) of natural forest with imported fast-growing tree species (gmelina and Caribbean pine) to feed the giant pulp mill; has built a railroad within the property to transport logs from the second-growth forest to the pulp mill; has discovered and developed a large deposit of kaolin, a material that will be used to whiten the output of a newsprint plant planned for the 1980s. To assure a supply of electric power for its future industrial operations, Jari is negotiating with the Brazilian government to build a large hydroelectric dam on the Jari River inside its property with support from the World Bank. The negotiations are politically delicate, as are most of Jari's other dealings with the Brazilian government, in this case because electricity generation has been reserved for a state monopoly, Eletrobras.

Because Ludwig does not give interviews or consent to be photographed, legends about him abound. One Italian newspaper, denied an interview, obtained revenge of a sort by telling its readers that Ludwig loved to shoot seagulls from his luxurious yacht and eat them raw. In 1950 a Reuters dispatch from Cannes told the world that he had Hitler aboard the yacht. In the Brazilian press Ludwig is sometimes portrayed as a vile billionaire who is raping the Amazon ecosystem. Stories have circulated about contraband exports of gold and uranium smuggled from Jari in Ludwig's ships, about a private army of green berets patrolling the great plantation and about enslavement of workers brought to Jari to clear the forest. His rare public appearances usually entail being trapped by photographers in an airport or during one of his visits with presidents and ministers in Brasília.

There are other legends of Ludwig as a King Midas with a passion for investment rather than accumulation; as an industrial visionary who moves boldly and quickly and who thinks far ahead of his time; as a silent and solitary man who loves his work for its own sake and not for the comforts and luxuries that wealth can bring. He wears cheap suits, shoes and even eyeglasses bought at bargain prices at department stores. Like the handful of other American billionaires who survived into the 1970s, Ludwig had little formal education and has always shunned both partners and stockholders, being the sole proprietor of virtually every business he has undertaken.

He usually travels alone, economy class, carrying his own baggage, arriving at tropical airports a few hours before dawn. In 1973 the Brazilian magazine *Visão* reported: "Generally he arrives at the Belém airport in the early hours on the plane that leaves Rio de Janeiro at midnight. He dislikes hotels; so he prefers to converse in a hangar, until the sun rises, with the half-dozen persons who awaited his plane. At dawn he climbs aboard the old DC-3 to fly to Jari." When a plane is delayed, he will roam about an airport, walking continuously, to relieve the agony in his back.

Section of the Ludwig plantation

Replacing 300 tree varieties with wood-producing gmelinas.

This pain began with an injury that occurred in 1926 aboard one of his first tankers, the Phoenix, a World War I surplus vessel. Two crewmen were overcome by gasoline fumes below decks while repairing a pump. As Ludwig went after them, the fumes exploded, blowing him upward through one deck and onto another some 25 feet away, where he landed. Although his injuries seemed minor at the time, they led to years of constant pain, at times so severe that he would faint momentarily or sit doubled up on a street curb, unable to stand up and enter a taxi. At times he conducted business meetings lying flat on his back on the office floor. In 1954 he underwent a delicate operation that greatly relieved his pain but required his spending nine months in a shoulders-to-knees cast. It was the only time Ludwig refused to discuss business.

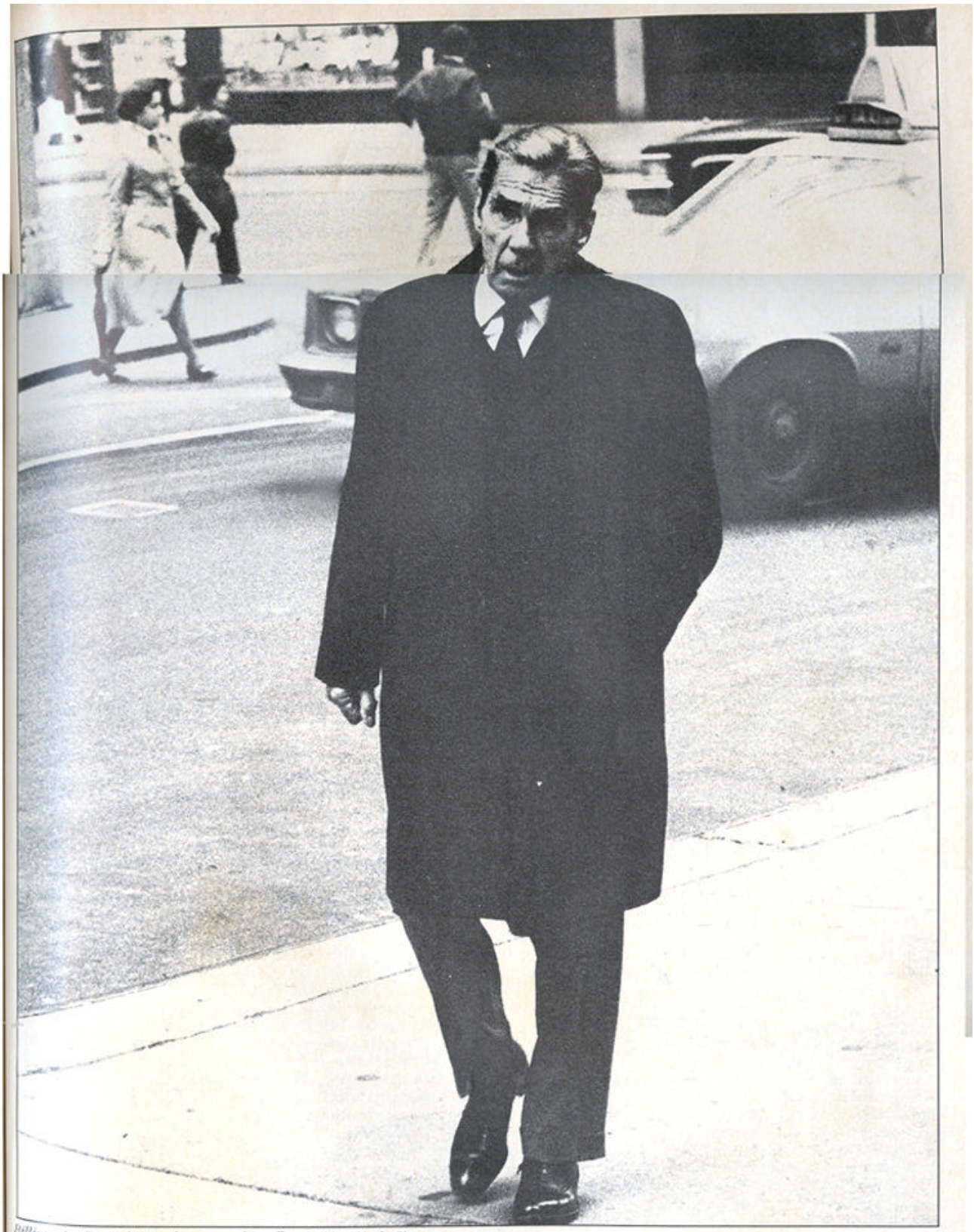
Ludwig's extraordinary business career has been characterized by incessant activity, an unending quest for bargains and an uncanny long-range vision that often has left his employees and associates confused. He has been salvaging and chartering discarded vessels since the age of nine—when he raised a sunken 26-foot boat, repaired it during the winter and rented it out the next summer. In his home town of South Haven, Mich., he was the manager of his friends' baseball team because he was no athlete and because he knew how to raise money for uniforms. During the 1920s and 1930s he struggled to keep one old tanker after another running while searching desperately for cargoes and charters. He moved into the office of a New York ship broker where, according to one friend, "he didn't even have a desk. He was working from a windowsill."

This persistence was rewarded only in the late 1930s. As the world oil trade expanded, he obtained a series of loans from New York banks that enabled him to buy and convert government-owned dry-cargo vessels into tankers. He financed new ship construction by borrowing on anticipated income from contracts on vessels chartered to the major oil companies. He operated a tiny shipyard in Virginia during World War II, building a fleet of new tankers that the government gave back to him after the war. In 1950 Ludwig rented the Kure naval yards at bargain rates from the Japanese government and began building bigger and bigger ships, using cheap Japanese labor. In 1968 *The Economist* of London said Ludwig, "having proved to the major oil companies that his big ships could provide them with cheaper transport than anyone else could offer . . . has stormed the dry-bulk shipping trade . . . by buying a large stake in the mining companies that dig up the cargo for his ships to carry. Mr. Ludwig now owns a large share of the new coal and iron ore developments in Australia, and also solar salt pans in Mexico. He has succeeded in selling his minerals to large Japanese companies, with the shipping thrown in as part of the long-term delivery contract stretching over a decade or more."

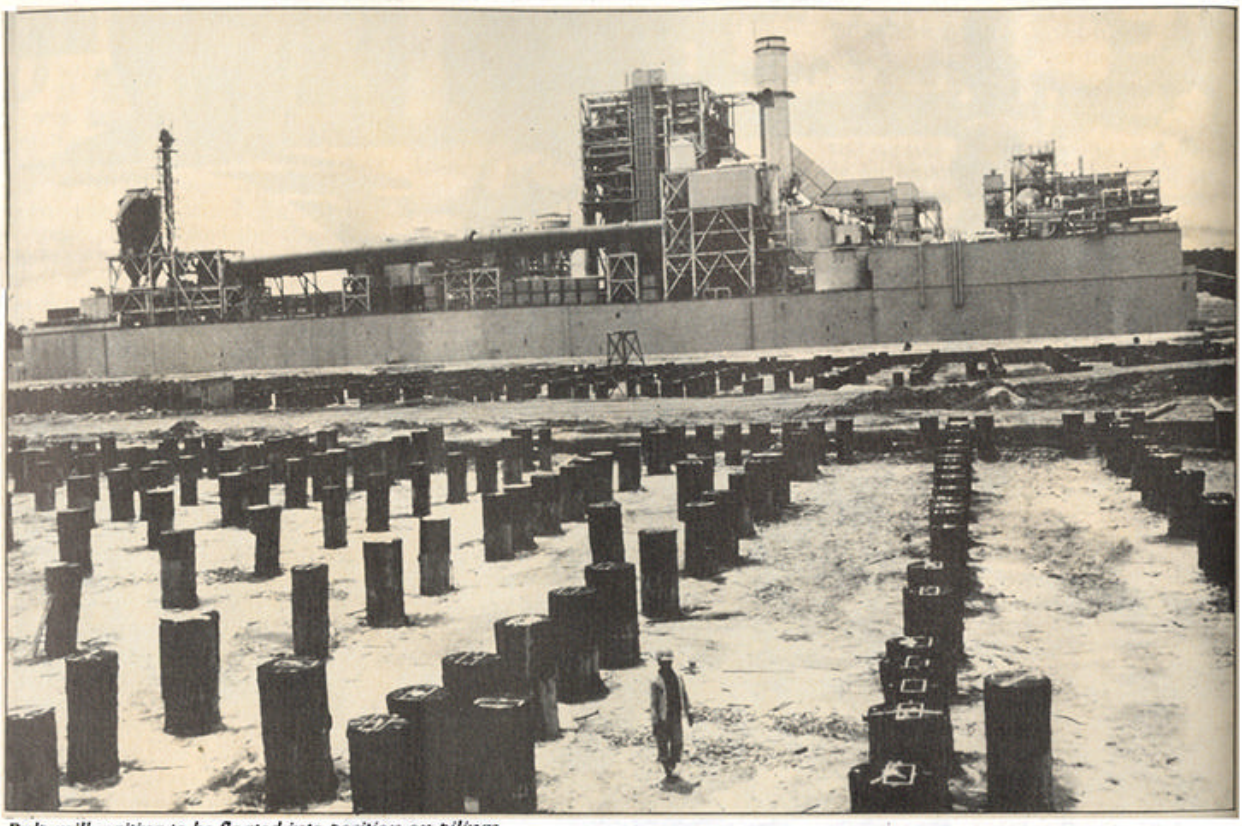
That is how Ludwig became so rich. But Jari is more grandiose than anything Ludwig has attempted before anywhere.

"At the end of his life," says Jari's administration and logistics manager, Luis Antonio Oliviera, a 40-year-old former General Motors executive from São Paulo, "Mr. Ludwig decided to create, in a pioneer area, a work that is entirely new, and is more concerned with achieving something of great socioeconomic significance than in reaping quick profits, like most capitalist enterprises."

Ludwig already has poured $740 million into what some skeptical bankers



Billionaire Daniel K. Ludwig near his office in New York City
At the age of 81, making long-range plans for an area larger than the state of Connecticut.



Pulp mill waiting to be floated into position on pilings
Ludwig assembled this $250 million plant in Japan and then had it towed 15,000 miles to Brazil.

and businessmen call a pothole in the Amazon. To sustain the activity, Ludwig has to maintain a fleet of river boats and airplanes to shuttle technicians and workers in and out of the jungle; to bring in a thousand head of live cattle, 75,000 chickens and 70 tons of frozen fish each month to feed these people and their families; to keep hundreds of cars and trucks and pieces of heavy construction and harvesting machinery running; and to build and maintain a private railroad, 450 kilometers of all-weather roads and 3,000 kilometers of access roads inside the plantation, as well as houses, schools, clinics, supermarkets and dining halls.

Nobody except Ludwig knows whether this massive investment really is meant to be recovered in profits. Escaping the comprehension of all but the members of Ludwig's tiny inner circle are the accounting procedures that could explain the relationship between Jari's huge infrastructure investments, current production costs and the enormous social overhead spending that is needed to support a complex enterprise grafted upon a remote area of the virgin forest.

Elmer L. Hann, 76, until recently the general manager of Jari, ran Ludwig's great shipyard in Japan for nearly three decades and is one of the billionaire's most trusted aides. "I don't know whether Jari is supposed to be economically viable in the sense of recovering a billion-dollar investment," Hann said, agreeing that Ludwig's aim simply may be to prove that Jari works as an economic system in the Amazon and can be profitable on the basis of current expenses and income.

Even if the cost of establishing Jari is never recovered, Ludwig already has realized some major achievements. One is that Jari is showing the way for the *várzea* (swampy) regions of the Amazon River and its tributaries to become one of the world's great rice-producing areas. The second is that forest-management techniques are being introduced into the upland *terra firma* of Amazonia by which fast-growing exotic tree species are replacing the heterogeneous native forest to strengthen Brazil's potential as one of the world's leading producers of pulp and paper. Because one kind of forest is replacing another on less than one-fourth of the area of the Jari plantation, the kind of ecological devastation associated with the cattle industry in Amazonia—indiscriminate burning of the forest, soil erosion and pasture degradation—so far has been avoided.

Despite all this, Ludwig's project is bucking a long-term historical trend. Foreign-owned agricultural and mining enclaves are fast disappearing from the developing countries of Asia, Africa and Latin America. Over the past ten years Latin American governments have expropriated the Anaconda and Kennecott copper mines in Chile, the Cerro de Pasco mines and the coastal sugar plantations (owned both by foreigners and the local oligarchy) in Peru, and the oilfields of Venezuela. At the same time, the empire of the United Fruit Co. in Central America and the Caribbean has shrunk substantially. Moreover, Ludwig and Jari are becoming enmeshed in the ecological debates over the human occupation of Amazonia and the economic nationalism that has grown rapidly as a part of Brazil's internal and diplomatic policy over the past decade. These political and ecological debates will grow as Brazil's congress and political parties gain more independence in coming years.

However, there are some basic differences between Jari and the foreign-owned plantations of the past. While colonial plantations produced mainly export commodities like sugar, bananas and cacao, Jari will produce basic necessities—rice and paper—which will satisfy Brazil's internal needs before export is permitted. Unlike the Dutch in Indonesia, for example, who expelled small rice farmers to create large estates producing sugar for export, Jari is bringing people to previously untilled

land to establish new modes of production that may be adopted elsewhere in Brazil.

Mechanized rice cultivation, the kind that is practiced in the diked and irrigated Louisiana bayou lands of the Mississippi River delta, has absorbed less than 5% of some $700 million that has been invested in Jari so far. However, the adaptation of large-scale rice production techniques to the *várzea* of the Amazon may be the most far-reaching and long-lasting of Jari's innovations.

Standing on the bluff at São Raimundo, a new community at the southernmost edge of the great plantation, one can see green rectangular rice fields laced by drainage and irrigation canals that stretch out toward the Island of Comandai, where water buffalo and cattle graze at the edge of the Amazon River, 25 kilometers away.

This land was a permanently flooded *várzea* when work began in 1974. Today there are houses, large machinery workshops, storage bins, a supermarket, a clinic, a $3 million rice mill under construction and an agricultural experiment station down a new road, where a small farm has been established specifically to grow seed for what should become the world's largest rice plantation by the mid-1980s.

Ludwig and his managers view rice production as only a minor facet of Jari's operations. Lately they have drawn money, manpower and machines away from the rice program to press forward with efforts of greater urgency and priority, such as the installation of the big pulp and power plants floated over from Japan. However, in 1978 Jari exported $2.3 million worth of rice to Italy, the project's first large commercial sale. This year its production is being sold in the Brazilian market to compensate for the shortages caused by drought. Rice has been harvested at Jari in two crops annually for the past two years from about 3,200 hectares of land presently cultivated. The annual yields per hectare, averaging nine tons, are the highest in the world, although farms in Taiwan and Australia have gotten eight tons per hectare in a one-crop annual cycle. Plans call for adding more dikes and 2,000 hectares of rice annually through the mid-1980s, when some 15,000 hectares will have been brought into production, forming the largest area of rice in the world under cultivation by a single owner. Even then only a small portion of Jari's rice-producing potential will have been realized. On an area next to São Raimundo is an even larger section, 40,000 hectares. In all, there are 200,000 hectares of *várzea* on the Jari property where rice could be produced.

Marvin R. Ragland, 46, is a leather-skinned farmer from Louisiana with a soft, syrupy voice who has supervised these rice operations from the beginning. Before coming to Jari, he pioneered a big rice plantation in Belize, Central America. "Being from the bayou country of Louisiana," Ragland said, "I always think first about rice when I think about developing a piece of swampy land. These *várzea* lands are very flat and have a lot of water, and that's what you need for irrigated rice. When you look from the mouth of the Amazon River up toward Peru, on either side of the river there is a vast spread of land similar to the *várzea* we have here. A man with an agriculturist's mind sees a monstrous breadbasket here. The Jari project is a pioneer effort to product rice and perhaps other crops on soils that were used previously only to graze water buffalo and cattle seasonally and for tiny subsistence plots grown by isolated families living along the rivers. Over the past decades there have been some tremendous advances in rice technology. One is the invention of propanil, a weed killer that has permitted increases of 20% or 25% in rice yields. Another, the new miracle rice varieties developed at the International Rice Research Institute in the Philippines, which is continually introducing new seed varieties that are resistant to insects and weeds. Their great miracle rice breakthrough was made with IR-8, a strain that greatly increased the rice tonnages that could be gotten per hectare of land. While technological revolutions occur now and then in food production, there always is a need for new land, and there are millions of hectares of *várzea* swamp in the Amazon basin. I have no doubt that Amazonia could become one of the world's greatest rice-producing regions. But along with this must come an infrastructure and a population in the area to support this production, and this takes time."

Rice harvesting equipment at Jari
Two crops per year and more tonnage per acre.

The cost of reclaiming and developing a hectare of *várzea* (including dikes) for rice production is about $500, about the same as for clearing a hectare for cattle-grazing in the Amazon. However, while cattle-raising in Amazonia is, at best, profitable only after many years and, meanwhile, is subject to soil erosion and pasture degradation, a rice producer can sell his first crop after 115 days in the field. Also the year-round availability of sunlight and water in Amazonia permits two crops annually.

The high productivity of Jari's rice operations barely suggests the rice-producing potentials of the 6.4 million hectares of *várzea* in the Brazilian portion of Amazonia. And beyond that, there are the floodplains of the Orinoco and Apure in Venezuela, the Magdalena and Cauca in Colombia and the scores of major rivers that flow eastward from the Andes in Ecuador, Peru and Bolivia to the Amazon.

Over the next century the balance of agricultural power between the north and south of Brazil could change in the same way as it did between the north and south after the introduction of paddy rice cultivation in southern China between the 8th and 12th centuries. In his great study of Chinese technological development, *Pattern of the Chinese Past*, Professor Mark Elvin writes that "mastery [in China] of the techniques of wet rice cultivation allowed a great southward migration into this previously little-developed area that became the dynamic driving force behind an era of economic revolution."

If such an "economic revolution" does occur in Brazil, it would place the Amazon in the tradition of the great river civilizations of the past, Egypt, Mesopotamia, India and China.

Irrigation works on the Nile go back 5,000 years. Why then has agricultural development of the Amazon floodplain been delayed so long? Perhaps because the land has been leached of nutrients, by the rains and by the rivers, for so many millions of years that large-scale, labor-intensive agriculture was impractical.

In 1948 geographer Pierre Gourou observed that the great jungle rivers of the world, the Amazon and the Congo, carried in their waters only a small fraction of the suspended nutrient material that is carried by the great agricultural rivers, such as the Mississippi and China's

Gmelina timber being stacked

After all Ludwig's efforts, pulp production could still be nationalized.

Huang He (Hoang Ho) and Changjiang (Yangtze).

The basins of the true tropical rivers have soils that are too leached to yield large quantities of silt and soluble products," Gourou wrote. "It is significant that at the beginning of the rainy season there is a rapid multiplication of plankton in the waters of the Amazon; once the rains have commenced, the plankton population reverts to normal. This is because the first rains, running over and through the soil after the dry season, carry small quantities of organic matter and even of mineral substances that stimulate the plankton. Once the first flush is over, the percolating waters resume their habitual poverty. Rivers in equatorial regions are incapable of building great alluvial plains of rich earth."

Have the agricultural methods introduced at Jari overcome these nutrient deficiencies? If so, do these technological adaptations represent merely a solution to local problems, or can they be applied over a broad area of the South American tropics?

The answer to these questions lies in the ability to build dikes and canals economically and to apply seed and chemicals with speed and precision at the right moment in the agricultural cycle, and in whether the energy and chemical inputs needed for mechanized agricultural production will be available over a broad area for a long time.

As in mechanized rice production elsewhere, the irrigated lands are planted, fertilized and sprayed with herbicides and pesticides by single-seat airplanes flying between three and five meters above the ground. "This operation is so dependent on airplanes because there is only ten days between a harvest and a new planting in the two-crop cycle," said Kevin M. Gayle, a young Louisiana farmer who left his family's agribusiness operations to work at Jari. "Heavy machinery can't work in the rice fields when they're flooded. Airplanes give us the flexibility to apply chemicals exactly when and where they're needed. There is very little that we're doing here that has not been standard practice back in Louisiana. The exciting thing about Jari is bringing these techniques to a new area and growing rice on a much larger scale than has been done anywhere else in the world."

The one significant technological innovation has come in mechanical methods of excavation to build dikes and canals. Originally, a $200,000 Jetco ditching machine was imported for this work, but it was never put into service because it sank into the *várzea* as it began to dig canals. So a new machine was devised: a back-hoe dredge that plants itself into the sides of the canal as

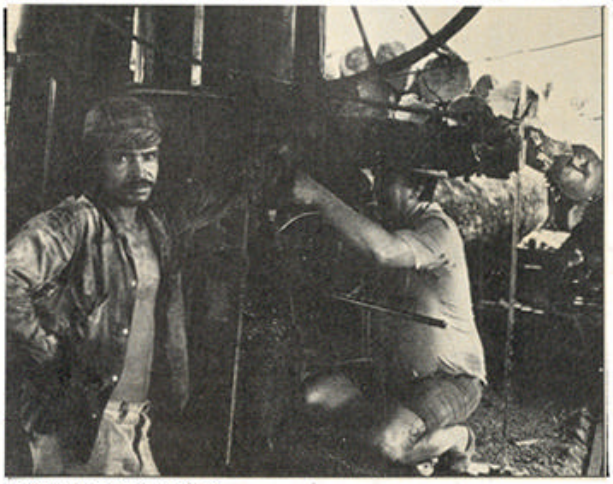
it digs its way through the fields.

The strain of the "miracle" rice seed, IR-22, which was imported from the Philippines, produced a type of rice that resists falling to the ground and germinating during the rainy season, the main problem of rice harvesting in the Amazon. In 1972 a Taiwan-born soil scientist, Dr. Chie Huang Wang, came to Jarilandia, an experimental *várzea* area of the Jari River where since 1969 Ludwig had been sponsoring the IRRI's studies on rice, sugar, oil palm *(dende)*, cotton, castor beans, soybeans. In 1974 Dr. Wang set up a new experimental station at São Raimundo when the entire rice operation was transferred to take advantage of the larger area available there for commercial farming.

"When we arrived here we found that 70% of the *várzea* land was permanently covered by water," Wang said. "At the same time, we found that the river doesn't deliver many nutrients during flooding. Although the water is muddy, it carries few nutrients and is almost chemically pure, like distilled water. We found the alluvial soils to be highly acid, but also with a high capacity to absorb nutrients, and the acidity is reduced as the land is repeatedly flooded and drained, so we don't have to use lime on the soil. We apply about the same amount of chemicals (fertilizers, herbicides, pesticides) per hectare as in other rice-producing areas of the world. Other areas, such as Louisiana, initially may be more fertile, but their fertility soon declines to the levels we have at Jari. Our main early problem was a sulfur deficiency in the soil. In 1972, after two successive rice crops on our experimental area, we found that our yields had suddenly declined from five or six tons per hectare to between one and three tons. After we discovered the sulfur deficiency and corrected it, our yields came back up to where they were, and we were ready to begin commercial production. But we continually have to search for new rice varieties to avoid losses from insects and diseases that overcome the resistance of the varieties we are using. We are continually receiving new strains from the Philippines and testing them here."

On the irrigated rice farms in Louisiana and Texas, rice must be rotated with other crops because of a weed problem and declining soil fertility over time. Soybeans, which restore nitrogen to the soil, are used as a second crop. But soybeans are not suitable for Amazon *várzeas* because the soil is too impermeable, thus alternately too wet and too dry. "We haven't been able to find a second crop for rotation," said a Jari technician, "so we have to keep going with rice." But the cost of buying and developing Amazon *várzea* for rice production is only about one-sixth of the purchase price of rice land in the Mississippi delta.

It is unlikely that Daniel Ludwig's extraordinary project in Amazonia will be fully realized. The long-term profitability of Jari is too uncertain; there are too many political problems, and Ludwig is too old to see the effort through personally for many more years. Yet, something important will be lost if this project goes no further, because Jari points to a sensible middle ground in Amazon development between the extremes of extensive devastation presently caused by cattle and timber operations and the concept of an "ecological museum" under which the tropical forest would remain a sacred preserve. What is needed is some kind of equilibrium between Amazonia's fragile and infertile ecosystem and the presently uncontrolled advance of men, money and machines into the equatorial forest.



Jari timber mill workers
The plantation's population is now 25,000.

Major international corporations such as Volkswagen, Goodyear and Liquigas are burning away the forest to make cattle ranches, but there are many more Brazilian firms, large and small, burning away a much greater area without the benefit of publicity. All of these firms and individuals are responding to the invitation and incentives of the Brazilian government to burn away the forest to create what are called cattle ranches. These seem to produce nothing but devastation, and at very great cost in government subsidies. But nearly all the sawmills in Amazonia now are Brazilian-owned. Proliferating rapidly, the sawmills have much more industrial capacity than there are commercial species of wood to supply them. Thus they are doing away with the most valuable kinds of wood very rapidly. Maintaining an ecological balance in Amazonia is a Brazilian responsibility. It cannot be shifted to others. Any attempt to do so would be an abdication of sovereignty.

Although Ludwig is pictured as one of the principal offenders in this invasion, he is not. His operating methods are different in that: 1) the agricultural and forestry projects were preceded by years of testing and research that still continues, and 2) the traditional ways of harvesting Amazonia's wealth are being replaced by capital-intensive ways of heightening productivity and of recycling that productivity in limited and carefully selected areas.

It is said that in the 1950s Ludwig had one of his intuitive visions that there would be a world fiber shortage in the mid-1980s. He sent one of his aides scouting about the world for the "perfect tree": one that would not only grow fast but also resist diseases and pests and produce not only pulp but also solid wood products—timber, veneer, plywood and particleboard. In Southeast Asia, the scout found *gmelina arborea*, a tree native to Burma and India, which Ludwig test-planted successfully in Honduras. Then he looked about for a large swath of land to sustain a major forestry operation based on the gmelina. He almost had settled on Nigeria, where the tree had been used for pit props in mines, but was discouraged by the political turmoil that led to the Biafran civil war. Although he had previously backed away from locating his project in Amazonia because of the turbulence surrounding the Goulart regime, Ludwig went to Brazil after a right-wing military regime seized power in 1964.

Jari's forestry experts point to two false starts at the beginning. One was clearing the land with tractors and bulldozers, which removed precious topsoil and nutrients. After they switched to traditional Brazilian methods of cutting and burning the forest, Jari's foresters found that the ash left in the soil was worth about $170 per hectare as a fertilizer and herbicide equivalent. Secondly, two years after the initial plantings, they found that the gmelina would not grow properly on sandy soils. So Caribbean pine was brought in to be planted on the sandy soil south of a geological fault that bisects the property, while gmelina grows north in the clayey soils that predominate as the land rises into the Guayana shield. Pine at Jari grows twice as fast and yields twice as much timber per hectare as pine in the

Cultivating rice in a former swamp
Feeding Brazil is the first priority.

U.S., while gmelina is ready to be cut only six or seven years after planting.

Ronald A. Woessner, the head of forestry research at Jari, looks toward a highly diversified future for these operations. "Some people think we're doing only one or two things here, but that's not true," says Woessner. "We started planting only gmelina, but then we started planting pine and now are developing eucalyptus for large-scale planting. When we have the wood supply assured for both the pulp plant that's just begun operations and for the plant we're planning to build, we will diversify into other crops. We will plant cacao, rubber and *castanha* (Brazil nuts) if their prices are high. The cacao may be especially good for planting in the shade of our trees. We now plant pasture and graze cattle between the rows of pine trees to help control the regrowth of wild vegetation that otherwise would have to be cut down by hand. Pasture must be managed intensively to avoid soil degradation. The question is not whether the land is changed with use, but whether the land can still be used."

Jari's expansion plans call for planting 100,000 more hectares of trees beyond the 100,000 already planted, and for another floating pulp mill adjoining the big newsprint plant that will be the next major component of the industrial complex. These installations would be powered by a 180-megawatt hydroelectric dam, costing $140 million, to be built on the Jari River along the geological fault that crosses the property, creating falls with an 800-mw electricity potential. There has been considerable tension between Ludwig and Brazilian authorities over the government approvals needed before Jari's expansion plans can be implemented. Ludwig claims the project will continue to lose large amounts of money unless it can produce more finished products and have enough electricity to sustain energy-intensive industrial production in a remote area.

Although Ludwig expected to spend $350 million on Jari when he bought the property in 1967, he will have invested more than triple that amount if the planned expansion is completed. A $400 million revolving credit has come from a syndicate led by the Chase Manhattan Bank, and another $250 million, to finance the floating power plant and pulp mill just installed, was lent by the Export-Import Bank of Japan with guarantees from Brazil's National Bank for Economic Development (BNDE). Ludwig's shipping company in New York has been paying $45 million in interest annually on these loans for Jari. To reduce these interest payments, Ludwig has sold a coal mine in Australia to British Petroleum and a gold mine in South Africa to pay off the Chase banking syndicate.

The Brazilian government has helped generously. One Jari staff member said: "I doubt if Jari would have been established but for the loan guarantees, the export programs and the related capital equipment import policies of the government. These have effectively reduced the cost and lightened the debt burden of Jari on the parent company, particularly during these years of startup when there has been no revenue whatsoever." But Jari's tax-free imports of machinery and other subsidies have become controversial within the Brazilian government.

In 1976 opposition by the board of governors of SUDAM (Superintendency for Amazon Development) to tax exemptions for Jari could only be overcome by the intervention of President Ernesto Geisel. One nationalist member of the SUDAM council, Warwick Estevam Kerr, director of the National Institute for Amazon Research (INPA) in Manaus, asked: "How can we justify tax exemptions for a company that doesn't even have headquarters in Brazil?"

Governor Arthur Henning of the Territory of Amapá, where part of Jari lies, said the project would have to be supervised to determine whether it helped development of the region, "and I ask my-

self whether the government could supervise an enterprise of this size."

The political climate for foreign-owned operations in Amazonia has become so tense and confused it seems, one way or another, Jari will come under Brazilian ownership. Why then in the last years of his life has Ludwig undertaken this project and what has he done to ensure Jari's survival? Ludwig has no heirs. His fortune will be left to a cancer foundation he established in Switzerland. Its head is Ludwig's chief financial adviser, John L. Notter, a Swiss-born former banker said to have been opposed to Jari from the start.

Before he dies, Ludwig may have to find an ownership and management formula to assure that the work at Jari will continue to justify the effort already made. If this is not done, the Brazilian government may be forced to be responsible for the 25,000 people living in this remote jungle area who would be unable to manage and develop Jari as an integrated enterprise. Then much of great value will have been lost. The same thing could happen to Jari as happened to Fordlandia, the giant rubber plantation opened by Henry Ford between 1928 and 1945 on Brazil's Tapajós River at a cost of $25 million. Fordlandia stands abandoned today, even though 800,000 of its trees still can produce rubber. If Daniel Ludwig ever visited Fordlandia he would probably offer to buy it cheap, and then turn it into a profitable operation. But, as with Jari, the big question is what happens after Ludwig dies. That is something Ludwig and the Brazilian government should settle now. ■

Jari headquarters from the air
Can one man's will and vision prevail?