Non-timber Forest Products in Peruvian Amazonia: Changing Patterns of Economic Exploitation

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Photographs by author

Non-timber forest products (NFTPs) are important for societies all over the world and consist of foods, fuel, fibers, thatch, construction materials, latex, resin, gums, medicines, dyes, hallucinogens, and a plethora of other plant materials that come from forest ecosystems. That people living near these resources may be dependent on them is not surprising. What makes these products unique is that people living in or near the forests are holders of the main body of knowledge concerning their use (Nuemann and Hirsch 2000). Non-timber forest resources from Amazonia have provided economic benefits to people across the globe for centuries; we need look no further than the chocolate and rubber industries to recognize this. These resources continue to be important today, especially to residents of Amazonian countries.

The terms "non-timber forest products" (NTFPs) and "non-timber forest resources" (NTFRs) are often mistakenly interchanged. While researchers have pointed out that thousands of NTFPs are used by people all over the world, we must remember that these products are environmental services, and part of the natural resource base. For that reason, it is best to look at these extracted products as wild and living forest resources. In the case of cacao, the seeds from the fruit are an example of a product from a non-timber forest resource, the tree. Except where noted, this article will consider non-timber forest resources (NTFRs) to be plant species.

When Europeans arrived in South America, they immediately noticed that the natives were using a multitude of plants from the forests (Denevan 1992). The Spaniards had expected to find gold, cinnamon, and other riches when the new lands were first explored and mapped in what is now the Amazon basin of Ecuador and Peru. They had heard that cinnamon could be found in these unexplored lands and were very interested, because Spain was hoping to counter the Orient's valuable cinnamon and cassia trees with a product of its own from the new world. Gonzalo Pizarro, who led the famous 1541 expedition into the Amazon Basin, dreamed of finding the land of canela (cinnamon) trees that the natives had described to them. Upon finding the cinnamon trees, he and his men were disappointed, as the trees did not grow in high densities but widely dispersed. The main reason for the Spaniards' frustration was that while the flower buds and leaves tasted like cinnamon, the trees were of course not true cinnamon, rather the genus Nectandra (Medina 1934). Francisco Orellana and a small group of men left the large, Pizarro expedition party and went further downriver to "discover" the Amazon River. By the 17th century, several explorers were traveling the Amazon and its tributaries.

The Jesuits and other Catholic denominations were important sources of written information as they took their religion to this huge region. Friar Gaspar de Carvajal served as the scribe on Orellana's trip down the Amazon, and it was often representatives of the church that described the natural resources encountered on these journeys. The Spaniard Padre Cristobal Acuña wrote of the downriver expedition of the Portuguese Pedro Teixeira. In 1639, Acuña was commissioned to describe the land, native peoples (who were called "Indians" by the Europeans), and natural resources for Spain. He was impressed that the forests held so much quality timber for ships, but he was equally amazed at the wealth of non-timber forest resources and their many products. Padre Acuña seemed to enjoy describing them, and he used many superlatives: "the most perfect sarsaparilla," "the most useful and abundant gums and resins...," "...wild honey (a medicine and a food), oils...," and "....a thousand species of other trees and herbs of particular uses..." (Acuña 1994, p.87).

NTFPs were often referred to as "drogas do sertão,"[1] or "drogas," because many of them were plant materials that were used as medicine. However, they also consisted of many different products not used as medicines, such as fibers, resins, dyes, spices, edible roots, nuts, fruits, and construction materials. Still, it was the medicinal use of these plant products that immediately caught the eye of the Europeans. Wild honey was both a food and a drug; *guaraná* was used as a painkiller, stimulant, and controlled hunger; and *andiroba* and *copaiba* were oils for healing and used in soaps. These products from the wild were important to the growing economy around Marajó Island in the 1600s, and Pará (Belém) was considered a small city by 1660 (Betendorf 1910).

Sarsaparilla, another plant growing in the Amazon, quickly entered international trade and became popular in Europe. "Sarsa," referred to the root of small trees and vines. Dried sarsaparilla roots were

[1] The *sertão* formally refers to the backlands of northeastern Brazil, separating the Atlantic coast from the Brazilian highlands. Early settlers preferred the coast to this forbidding environment, and tended to refer to any part of the tropical Brazilian interior as the *sertão*, including Amazonia.

shipped to Europe to make medicinal teas, elixirs, and a number of medicines. The root was also a favorite with colonists and sailors. Brazil nuts were becoming popular in Europe and North America, and cacao was extracted from the forest in increasing quantities. These early accounts show that barely a century after Pizarro's and Francisco Orellana's expedition to the "Land of Cinnamon," non-timber forest products of the region had become desirable to Europeans. By the 17th century, NTFPs from the Amazon supported important economies, and were seen as having the most economic potential for the region, even in comaprison to cultivated crops, such as cotton and sugar cane (Bettendorf 1910). They were a source of local development and a key reason for the establishment of the first towns of the Amazon. Demand for the wild product cacao would grow quickly during the next decades.

The NTFPs were extracted from isolated locations in the Amazon Basin and supplied distant overseas markets. Consequently, it usually took months to get them from the forest to a ship bound for the Atlantic. Not surprisingly, harvesting these resources from the forest relied on the knowledge and skill of native labor.

While it is difficult to ascertain the economic value of the multitude of NTFPs (except for cacao) to the Amazonian economy during the 18th century, they were no doubt of immense importance because they were so sought after in Brazil and coveted by Europeans. It wasn't until the 20th century that timber became a major industry in the Amazon, although its quality was admired by Europeans and it was used to build ships.

It was cacao (or chocolate) that became so popular as a hot drink in Europe in the 18th century that it grew into the primary export of the Amazon by the 1730s. There was a need to hire extractors to harvest it from and the process of collection was difficult and time-consuming. To boost production, colonists began planting cacao trees and expanding natural cacao groves in Brazil. Once again, they were reliant upon native knowledge and labor to make this work, since cacao was quite vulnerable to disease where it was cultivated. Cacao alone made up 60% of Brazil's export earnings from the Amazon in 1760 (Hemming 1987), a time when many other countries in the neotropics were also cultivating the trees and entering this risky but lucrative business. Cacao remained important to the Amazon economy, even though production moved into the Bahia region in Brazil and over to Africa during the 19th century (Clarence-Smith 2000).

By 1850, the Amazon forests had undergone over 300 years of exploitation for domestic and international trade, even before the rubber boom which brought so much attention to the Amazon. Then, as now, the Amazon was viewed as a great medicine cabinet. Naturalists exploring the region such as Henry Walter Bates and Richard Spruce, were commissioned to research plant medicines and poisons. Their work allowed them to learn about a huge variety of forest products, and they seemed especially impressed by the many materials available from palm trees, whose fruits, thatch, and use in drinks quickly attracted their interest (Bates 1962, Spruce 1970). However, they also noticed the decline in abundance of these forest products as well as some wildlife. Bates (1962) observed that this decline was especially common in the lower Amazon, where most settlers were located, near the towns of Santarém and Belém.

European scientists were also very interested in rubber, and they had been learning about its curious properties since the early 1700s. Using a rubber coating on materials such as shoes were common in the Amazon and rubber was exported elsewhere long before anyone had thought of pneumatic tires. It became a raw material for industry by 1850 and came almost entirely from the forest. Rubber trees, however, were highly dispersed in the forests, and the rubber-tapping, processing, and transport was time-consuming and risky, thus making rubber from the Amazon an expensive commodity. This caused a boom in rubber tapping, and profits from the trade allowed the region to prosper in dramatic and unique ways (Barham and Coomes 1996). Seeds from the trees were taken from Brazil to England in 1876 and quickly sent to Asia. Free from the leaf blight that attacked rubber in Amazonia, efficient plantations flourished there, lowering costs and dropping world prices for the raw material. By 1920, in less than half a century, the Amazon rubber boom period had ended. Asia quickly became and still is the world's main producer of natural rubber.

Rubber is a prime example of the "boom and bust" phenomenon attributed to NTFP economies. The problem with extraction is that the cost of extracting a wild resource usually rises almost as fast as production does (as it did for rubber), while plantations can raise production with only minimal cost increases. Sheer distance and the logistics of forest economies in the Amazon were extremely challenging to the entrepreneur, and they still are today. Rubber and cacao are just two examples of NTFPs entering international trade; where they were subsequently domesticated and grown as farmed crops. Synthetic, petroleum-based products have replaced natural rubber in many applications further eroding the market value of natural rubber from the forests of Amazonia. To some experts, this economic decline is considered inevitable after a NTFP enters international markets because of the domestication and cultivation of the product or the development of industrial substitutes for it. Homma (1992) states that either one or both of these factors will cause the end of an extractive economy. This process is not only common but can be dramatic and rapid, hence the reference to "boom and bust" in relation to the extractive industries in Amazonia.

Today, the economic potential of NTFPs from the Amazon remains enormous and underappreciated as we are only beginning to determine their economic worth (Smith 1999). The subsistence value alone of these products to residents of Amazonian countries is enormous, perhaps incalculable. Their economic value is often overlooked, because the attention of development practitioners tends to focus on the export of timber and agricultural products from this vast region. Government agencies view fields of maize or cattle as "development" and tend to view NTFRs as resources of the past with importance only to native societies. However, Carl Sauer, the father of cultural geography, reminds us that natural resources are in fact cultural appraisals, and an environment can only be described in terms of the knowledge and preferences of the occupying persons (Sauer 1952).

Today, the exploitation of non-timber forest resources is often seen as a way to prevent deforestation and conserve forests. It is part of the new "use it or lose it" philosophy that has altered our thinking about the value of forests (Freese 1997). Timbering is usually viewed as an activity that destroys tropical forests, although recent programs are trying to change this. The extraction of NTFPs is now under scrutiny to determine if such products can indeed be harvested in a sustainable way and if the revenues are high enough to provide an economic alternative to deforestation. There is general agreement that NTFPs provide significant incomes for households, particularly in forested areas. This income may be highly irregular and distributed unevenly, but rural poverty makes even low value resources all the more important for those people. For example, the palm hearts industry alone in the Amazon estuary of Brazil employs some 30,000 people and generates $300 million in sales annually (Clay 1997). Canned and bottled palm hearts represent how adding value to these forest products improves their economic value, especially for local and regional economies.

In western Amazonia, native fruit trees from the Peruvian Amazon continue to stand out as some of the most ecologically and economically viable NTFRs for rural people (Peters et al. 1989). While the high species diversity in Amazonian forests limits the density of any one species, tens of millions of hectares of forest are dominated by just a few species. Many of them contain dense populations of useful plant species, such as palms and fruit trees. The açaí palm in Brazil is a well-known example of this. Research has shown that the extraction of products from these very productive forests has sustained important economies and can be managed to produce high yields of valuable forest products for both rural and urban residents of Amazonia. Secondary forests, or fallow areas, also provide an abundance of readily available plant species of increasing economic value (Denevan and Padoch 1988, Coomes and Burt 2001). Here, I examine four examples of NTFPs marketed from the Peruvian Amazon: aguaje palm fruits, camu camu fruits, charcoal, and piassaba palm fibers. The boom and bust economic pattern does not yet apply to contemporary trade in these NTFPs, but conservation issues now exist as urban demand for these products continues to grow into the 21st century.

Aguaje Palm Fruits

One instance of a modern, developed industry that depends on NTFPs is the frozen treats and cold drink business in the rapidly growing urban center of Iquitos (population 420,000), Peru's largest city in the Amazon. The principal NTFP for this industry is the fruit from the aguaje palm. The aguaje palm is the most abundant and economically important palm in western Amazonia (Peters et al. 1989). Selling the fruit is an important source of income and employment, not to mention the many products made from aguaje. Over 20 tons of the fruit are consumed daily in Iquitos, and the price is rising. A 40 kilo sack of the fruit used to sell for just a few dollars, but a sack of high quality fruit now costs as much as $30 (Nube 2006). Unfortunately, most of the earnings usually go to intermediaries, or the middlemen, rather than the rural residents who harvest the fruit.

Aguaje is a massive, single-stemmed palm widely distributed throughout lowland Amazonia and especially abundant in Peru. Forests dominated by aguaje occur in permanently wet, swampy habitats. The palm swamps cover more than three million hectares in Peru. In the wild, aguaje palms can grow to a height of over 30 meters, and because the palm's trunk is difficult to climb, they are felled in order to harvest the large bunches of fruit. Additionally, it is a species where only the females bear fruit. As a result, alarming numbers of female aguaje palms are cut down yearly to provide for market needs, and fruit-bearing palms are now rare in the swamps, even in relatively isolated areas (Penn and Neise 2004). A keystone forest species, aguaje is also important to the diet of mammals, including large game species, such as peccaries and tapir (Bodmer et al. 1997). Thus, this destructive harvesting benefits neither the rainforest nor the rainforest people's economy, and the mountains of aguaje fruit, ice cream, and popsicles consumed daily in Amazon towns come at great environmental cost. Recent efforts to produce devices to climb the palms have been effective in a few areas, but most aguaje fruit still comes from palms that have been cut down in the forest. High quality aguaje is now hard to find, because the best quality fruit from the most productive palms is the first to be harvested. Each year the remaining palms are more difficult to reach. The competition for aguaje within the forest also causes it to be harvested when unripe, fetching a low price. This means more labor for the extractors, who earn less income when selling poor quality fruit. Even if most rural extractors learn to climb the palms, aguaje swamps are often so heavily damaged that those who harvest the fruit will have to be careful to allow for the regeneration of this species in its habitat. A final problem is that since the most productive palms with the best quality fruits have been destroyed over the years, genetic erosion has resulted.

Because quality aguaje is now scarce in areas close to villages and towns, an alternative to this destructive harvesting has been to cultivate the palms in settlement zones. When adequately spaced in a field, the large aguaje palms mature in 12-15 years and remain short. The huge fruit bunches hang just 3-5 meters off the ground and can easily be cut without having to fell the palm (***Photo 1***). The palm can then produce year after year, thus providing a

Photo 1: *Cultivated aguaje plam*

Photo 2: *A woman selling aguaje in the City of Iquitos*

Photo 3: *Camu camu tree*

sustainable source of income. The owner can harvest the fruit bunch by bunch at optimum ripeness and select the best varieties in order to make the most money (Penn and Neise 2004). By planting aguaje palms in their gardens, the people can reduce and eliminate the need to destroy aguaje palms in the forest and leave these important trees for animals to feed upon. Indeed, more than ever, aguaje fruit will need to come from locations like the agricultural zones near Iquitos because aguaje from more distant locations is shipped in large boats carrying huge amounts of the fruit, which flood the market and result in very low earnings for extractors of wild fruit. Unfortunately, cultivating the palms has had limited appeal to farmers because of the labor required to weed the young palms, the time the palms take to reach maturity, and because farmers cannot determine if a young palm will be male or female. The strong cultural preference for aguaje is distinct to Peru, and the need for aguaje fruit is currently even more acute to meet market demands in the growing cities of the Peruvian Amazon: Iquitos, Pucallpa, and Tarapoto. In Iquitos, you see hundreds of women selling the fruit (***Photo 2***) and people eating aguaje ice cream and popsicles. Economic hardship has recently caused men to sell peeled aguaje and aguaje products on the streets, an occupation traditionally practiced exclusively by women and children. Aguaje is very high in Vitamin A, recently creating wider interest in it as a health food.

With world concern over global warming, the detritus-rich swamps of the Amazon are now considered to be especially important stores of carbon, another factor which can promote their conservation. Ironically, at the same time, planners concerned with petroleum supplies are beginning to view aguaje palm swamps as a natural source of biofuels, along with the cultivation of aguaje palms and other palm species in large plantations for this purpose. This raises grave concerns about the conservation of Amazonian forests if aguaje swamps are suddenly exploited as a source of biofuel, or if large areas are deforested to establish palm plantations for biodiesel. Petroleum extraction has already polluted the Amazon basin for decades, and new exploration efforts promise to increase production across vast expanses of the region. It was the internal combustion engine that created an appetite for rubber and focused world attention on Amazonia. A century later, the need to fuel these engines now threatens to destroy Amazonian forests, even as policy makers debate the value of Amazonian ecosystems to mitigate global warming.

Camu camu

A relatively new NTFP from the region, camu camu fruit, captured the attention of scientists in Peru during the 1950s for its chemical properties and quietly entered international trade. Camu camu is a small tree native to the wetlands of the Amazon Basin and is especially abundant in northeastern Peruvian Amazon (***Photo 3***). Until recently in Peru, camu camu was used almost exclusively as fish bait and as a convenient source of firewood. The fruit pulp is extremely high in vitamin C, around 2.7 grams of ascorbic acid per 100 grams of pulp, or about 30 times that of an orange. Camu camu has become popular in drinks, popsicles, candy, and even cosmetics. The fruit pulp is exported from Peru, with most of it going to Japan (Penn 2006). Like aguaje palms, camu camu trees also have a patchy distribution and form dense stands. The tree is highly productive, with some studies of wild populations estimating fruit production at 9,000 kilograms or more per hectare, giving the dense stands of camu camu the potential to generate excellent income for rural extractors (Peters and Hammond 1990). Unlike the destructive harvests of wild aguaje, the cherry-sized camu camu fruit can be easily reached and picked by hand in a nondestructive fashion (***Photo 4***).

Researchers were intrigued by the ability of camu camu to thrive in flooded environments, and experimental cultivation projects began in the 1960s. Farming options are limited in floodplain environments, exactly where the more fertile soils exist and where most people in the region tend to settle. Agricultural specialists saw camu camu as a flood-resistant, highly productive tree crop for use in agroforestry systems as a way to improve rural incomes and standards of living. Camu camu planting in Peru

Photo 4: *Camu camu fruit*

suddenly "boomed" in the mid-1990s through government and non-governmental organizations, or NGO-funded projects with the goal of exporting large quantities of the fruit pulp to buyers in Japan. Programs initially aimed to plant 10,000 hectares of camu camu, assist 10,000 rural smallholders next to the floodplains to supplement wild harvests, and raise household incomes. In this environment, the cultivation of native tree species was viewed as an ideal form of sustainable development. However, by 2004, only a small number of farmers were actually cultivating the fruit. This was due to three main factors:

1. *The great haste in which the planting programs had been implemented, with almost no agricultural extension support;*
2. *Riverine lands in the program areas were already widely cultivated with high value annual crops;*
3. *A shortage of local labor needed to weed and maintain the young saplings as they grew (Penn 2006).*

Along with entire families abandoning their agricultural traditions and moving into towns and cities, parents are now sending the majority of their children to urban areas in search of an education. This demographic change has greatly impacted land use practices in many ways and created a situation where rural programs must provide loans or subsidize agricultural labor if they are to be adopted by large numbers of farmers. In some ways, this situation may have benefited conservation. Just 10% of the new camu camu fields were planted where mature forest had to be cleared, with the other 90% planted in fallow areas or permanently cropped lands. In the latter, we see the return of tree crops to deforested areas and of fish, which use the camu camu trees as habitat during high-water periods.

Instead of planting the perishable fruit near towns and processing facilities, camu camu cultivation usually began with families who were familiar with the fruit and lived near wild stands, which helps explain the geographic pattern of cultivation that emerged on the floodplains of the Peruvian Amazon (Penn 2006). This pattern resembles the early cultivation of another water-loving plant in the United States, cranberries (Berlin 2002), and is referred to as adjacent domestication (Sauer 1993). Like cranberry growers in Wisconsin, camu camu growers in Peru selected lands in the same environment in order to expand production of what had been an exclusively wild fruit. *Figure 1* illustrates this pattern. The yellow dots are wild stands of camu camu along the Tahuayo River, while the red dots represent planted fields. Cultivation then spread to the Muyuy Islands as more was learned about this fast-growing tree species. A notable exception to this pattern is near the city of Pucallpa, where wild camu camu does not exist but superior processing facilities do. A beverage company interested in exporting fruit pulp helped encourage locals to plant the trees, who quickly developed a taste of their own for the new fruit. Camu camu farmers consistently earn high prices in Pucallpa for their fruit (from $.50 to $2 per kilo!).

Improved sanitation in processing plants has recently helped revive international demand for camu camu, with buyers paying up to $1 per kilo directly to local harvesters (Pinedo-Panduro and Penn 2008). Revenues from the trade have risen from $500,000 in 1996 to $4.7 million in 2007 (Pinedo-Panduro and Penn 2008). Even though floodwaters can destroy the fruits, and camu camu forests are widely scattered in patches across this vast region, fruit buyers prefer local harvesters as the quickest and easiest way to supply what they need. Villages that are lucky enough to be located near stands of wild camu camu have earned from 25-50% of their annual

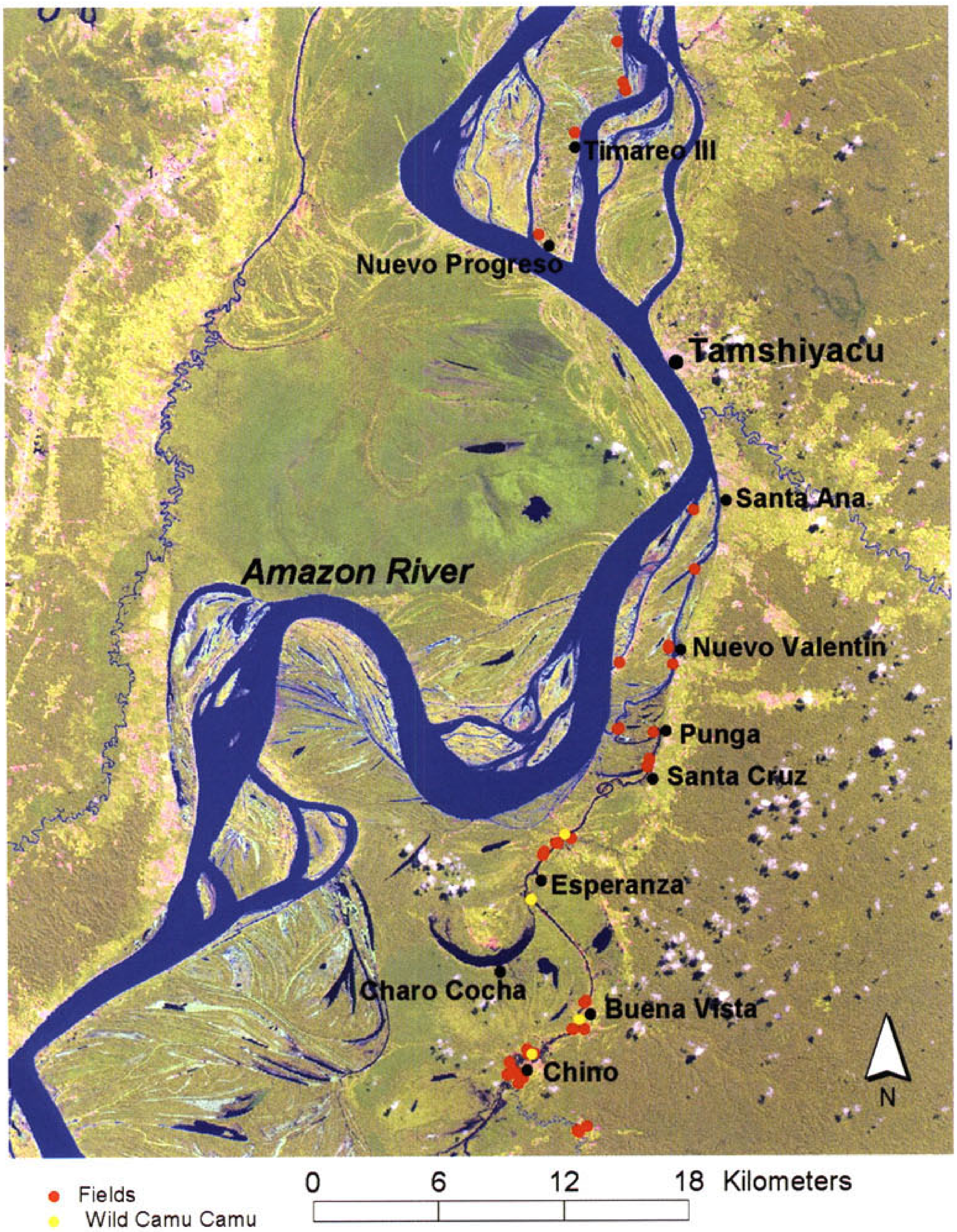

Figure 1: Spatial pattern of fields and wild camu camu.

income from it. Compared to aguaje, a much larger portion of the earnings from camu camu is pocketed by rural residents who harvest the fruit.

There is concern over how much harvesting the wild stands can take. As with aguaje, fauna are also dependent on camu camu fruit, in this case, fish. Some species of fish feed on the fruits, and they have almost disappeared from places where camu camu fruit is no longer available to them. Aggressive harvesters damage the trees, and even unexploited stands of the trees can shrink in size or die off quickly for unknown reasons. Political changes, coupled with the recent increases in price and international demand, have initiated a new round of camu camu planting programs. The present ecological concern is with deforestation. Rumors and promises of government assistance have caused rural residents to cut down forests to prepare camu camu fields, and new planting programs may cause farmers to deforest large areas.

Camu camu is relatively easy to cultivate and by six years can bring excellent returns. If prices for the fruit remain high, more rural people will dedicate their time and efforts to growing camu camu trees in gardens, along with a mix of different annual and perennial crops. As is the case with aguaje palms, camu camu is becoming a common component of multispecies floodplain agroforestry systems in northeastern Peru. To be successful, there is a need to improve extension work, as well as farmer access to processing facilities and markets. Sustained and equitable programs are needed to assist the people with the cultivation and management of camu camu. Unfortunately, discrimination against rural people of the Amazon frequently ruins conservation and development plans. Moreover, dependence on cheap labor and exports of primary products, such as fruit pulp, can also impede development and repeat the cycle of economic boom and bust in Amazonia. A key way to avoid this is to produce value-added camu camu products in Peru for the domestic market that are tasty and create a new line of high-quality items. A secure line of these products in Peru would benefit national nutrition and make it easier to export finished items.

Charcoal Making

Many villages have a history of fuel production, beginning as sources of firewood for steamboats during the 19th century. The expansion of charcoal making is a relatively recent phenomenon related to rapid urban growth in the region and jumps in fuel prices. Charcoal makers generally use a number of tree species from a small area to make their product. There was already significant demand for firewood and charcoal to provide fuel to restaurants and bakeries, but the huge rise in fuel prices during the 1990s also made it cheaper to burn charcoal in urban homes instead of kerosene. Charcoal consumption rose steadily during this period as large numbers of rural residents turned to charcoal making as a source of income. Charcoal making is usually an upland activity, because the hardwoods that make the best charcoal are more common in non-flooded environments.

Like camu camu picking, charcoal making is far less labor-intensive and brings much quicker returns than agriculture. Charcoal is a nonperishable product that can be stored and then taken to market when prices are high or there is a need to go to town. The charcoal is made in slow-burning, domed ovens, which produce from 100 to 200 sacks of charcoal. The wood comes from clearing forests for new gardens, or is selected from standing forests. Instead of mature forests, old fallows or secondary forests are usually easiest to exploit for preferred species to produce charcoal of manageable size. The wood must be dried before it can be used. It takes only 2-3 men two weeks to cut and split the wood, prepare the oven, and make charcoal. One hundred sacks of charcoal can bring \$100-\$200 in profit, even after shipping costs. Older men often do this work, and they pay another person or two to help them, who in turn learn the art in the process. Competition in the trade has increased to the point that charcoal makers now charge a fee or demand other compensation from the people to whom they teach this skill. Many of these men now work with their wives (***Photo 5***), not only because their sons have left for the cities but in order to keep the activity strictly to themselves. They often send their product to family members in the city who re-package it into smaller, higher-priced quantities to sell in their neighborhood.

Charcoal making is now practiced by large numbers of people in the region, regardless of their economic status. Coomes and Burt (2001) have found that this activity supports many rural families without causing notable forest destruction. However, Peruvian authorities consider the recent boom in charcoal making to be a destructive and wasteful practice requiring the use of much forest for little production. Laws now forbid the practice of charcoal making and limit the sale of charcoal by any one producer. These laws are difficult to enforce, and high rates of poverty make enforcement a divisive issue.

Charcoal making was most common in upland areas along roads leading out of the urban centers of Iquitos, Pucallpa, and Tarapoto, but it is now increasingly prominent along the riverine areas of

Photo 5: *Bagging charcoal*

Loreto Province, where boat transportation is available and enforcement of forestry laws is more difficult. Charcoal making near Iquitos lends credence to claims that it is an overly destructive practice, but this may not be the case elsewhere. For example, around Pucallpa, a city located on the Ucayali River and connected by road to the Pacific Coast, most charcoal is actually made from waste wood at sawmills. It is sent to Andean towns and to Lima by road, along with other products from the Amazon, such as fish, timber, and produce.

The decision to make charcoal is partly due to a shortage of labor in rural areas. Young people are encouraged to emigrate to cities, thus reducing family sizes, which makes agriculture all the more challenging for traditional farmers. Rural farmers must earn money not only to buy seeds and supplies but need quick sources of cash to pay for labor, support family members who have emigrated to cities, or as savings to help themselves emigrate. Charcoal is an urban necessity for the rapidly growing towns of the Peruvian Amazon. Policy makers who demand an alternative to charcoal often fail to recognize that charcoal making is in fact an alternative itself to the declining labor-intensive agriculture.

Pissaba Fiber and Broom Making

Yet another NTFP from forests of the Peruvian Amazon has experienced a recent rise in sales: pissaba fiber. In this case, the main source of pissaba fiber comes from the high jungle, or *selva alta,* of Peru, located on the fringes of the Andes. The piassaba palm is a medium-sized palm with leaf and petiole fibers that form a mass at the top of the stem. It is used in broom making. There are a few detailed studies of this species (Borgtoft-Pederson 1996). It is unique to a palm genus that should not be confused with other palms called "piassaba" in Brazil or elsewhere in Amazonia.

The sudden boom in demand for the fiber to use in broom making is caused by the sudden decline in demand for another natural product coming from the same area—coca leaf. The U.S. "War on Drugs" led to massive, repeated coca eradication campaigns across the Huallaga River Valley, a center of Peru's production for the cocaine trade. By 1995, coca-growing families had no choice but to look for alternative income, and many turned to the old art of making brooms from piassaba fibers. Alternative crop programs proved mostly ineffective as poverty increased, causing large numbers of peasants, especially children, to move to Tarapoto or elsewhere in Peru. Brooms and brushes made from the stiff, wiry piassaba fiber are now found in markets and stores all over Peru, but the usefulness of this palm species remains hidden from the general public. If you ask what the broom fibers are made of, very few people will be able to tell you. Meanwhile, they have learned that these brooms are less expensive than plastic versions and are a great way to do the most dirty work requiring a cheap broom.

Far from the sources of the fiber, people all over Peru are engaged in piassaba broom making and selling. A cottage industry, scrap pieces of wood from sawmills are used for the handles and broom heads. In Iquitos alone, dozens of small factories produce thousands of brooms daily, and an unknown number of families make brooms right in their houses (***Photo 6***). Hundreds of broom sellers ply the streets. You also see aguaje sellers carrying dozens of bags of aguaje fruits strung out on broom handles hoisted on their shoulders doing the same thingtrying to make a living. The brooms sell for as little as $6 or $7 per dozen. Piassaba brooms are also made right in isolated villages along the Huallaga River. With the failure of alternative crops programs, food aid from the United States is now distributed to these impoverished villages (***Photo*** *7*).

The need for sustainable harvesting of piassaba fiber is now a conservation issue. This palm is either cut down or climbed to reach the fibers at the top of the stem. In a new study, Mayer (2006) developed a harvest model and found that one-fifth of the palms in these forests could be harvested for fiber each year (without felling), providing $1500 in annual earnings to poverty-stricken extractors (harvesters), who are now very dependent on fiber extraction for their household income.

Photo 6: Pissaba broom maker

However, the study also showed that although buyers in Huallaga claim to pay $.40-$.60 per kilo of fiber to extractors, most families make just $300-$400. The palms are often cut down and harvesting of the fiber is at unsustainable levels.

For centuries, a multitude of physical, economic, and cultural geographic factors have strongly influenced the use, marketing, and domestication of NTFRs all over the world. Sustaining these extractive industries in the Amazon has been especially challenging, since historically, access to both the resource and markets tended to be difficult or limited. The sheer isolation and distance that had to be covered in the Amazon to extract and market these resources limited the settings where these activities were managed and practical. Their location relative to markets in the Amazon is a crucial factor that still affects the development of their trade and management, as well as the locations where Amazonian peasants choose to settle. The isolation of the Amazon basin, not only from other areas of the Amazonian countries but even within its own population, makes growth and development a formidable challenge. Until systems of transport and infrastructure improve, even the most productive forests in the region remain limited in their economic value to rural inhabitants. At the

Photo 7: *Food aid for Huallaga River villagers*

same time, high rates of poverty have made them all the more important. Their economic value has also become critical for urban populations, now the majority in Amazonia.

Much of the local knowledge that was shared with the first European explorers in the region is already gone (Miller et. al. 2006). Cultural and demographic changes continue to threaten the conservation of this ethnobotany. Concurrently, present day uses of these plants have created new demands on these species both in the wild and in agricultural settings. Discussions have historically focused on the need to further develop and export NTFPs from this region, but the use of wild species must now be managed before promoting the expansion of their uses. The domestication of these resources through cultivation can provide promising alternatives but only if their cultivation is carefully managed. Both managed extraction and cultivation require improved and sustained cooperation between researchers, entrepreneurs, and rural residents. Today, as in the past, NTFP economies are not independent nor operate in a closed economy but are linked to and affected by developments in regional, national, and global economies. As we enter the 21st century, we see renewed international interest in the chemical properties of these resources not only for medicine but also for vitamins and biofuels.

Demographic changes, especially urbanization, are rapidly taking priceless local knowledge from the forests of Amazonia. This process is also impacting land use as farmers are forced to turn away from their traditional, more sustainable agroforestry practices. Over half the total area of Peru is part of the Amazon Basin and remains heavily forested, but this standing forest does not assure that biodiversity is being protected. The presence of vast forests may cause bureaucrats, the public, and visitors to believe that it is an endless supply of resources and land, as the first European explorers had believed. What there often is, however, is a degraded forest, devoid of many species, which have key ecological roles. Non-timber forest products help illustrate how patterns of change have impacted resource use in the Amazon for centuries and continue to do so today. The people of Amazonia have adapted to these changing conditions with skill, ingenuity, and perseverance. The four cases examined here provide us with important lessons that will help us to manage the world's largest tropical forest into the 21st century.

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