FOOD FROM THE FOREST: THE PERUVIAN CASE

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RUIZ MURRIETA, J. 1992. Food from the forest: the Peruvian case. The paper examines the main causes of deforestation in the Peruvian Amazon, that is rapid population growth and agriculture. The process of modernisation has led to negative changes in the pattern of food production from the forest and of traditionally grown food items. Past agriculture research in the Peruvian Amazon has not been realistic by ignoring the culture and needs of the Amazon people, and forestry research has concentrated mainly on timber production. The realisation that the natural forest is still the mainstay of the people for their basic needs has, however, initiated research in the Peruvian Amazon on its role as sources of food. The Amazon Forestry Research Programme (AFRP), formed in 1987, is actively paying more attention to the conservation of the forest and its role in providing basic products such as food and medicine, as an alternative to deforestation.

Key words: Peruvian Amazon - deforestation - causes - conservation - food - medicine

RUIZ MURRIETA, J. 1992. Makanan dari hutan: kes Peru. Kertas kerja ini mengkaji sebab-sebab utama terjadinya pembasmian hutan di Amazon Peru, iaitu pertanian dan pertumbuhan penduduk yang pesat. Proses permodenan telah mengakibatkan perubahan negatif pada corak pengeluaran makanan dari hutan dan bahan-bahan makanan yang ditanam secara tradisi. Penyelidikan pertanian Amazon Peru pada masa-masa lalu tidak realistik kerana tidak mengambil kira kebudayaan dan keperluan penduduk Amazon manakala penyelidikan perhutanan memberi tumpuan khusus kepada pengeluaran kayu sahaja. Walaubagaimana pun menyedari hakikat bahawa hutan asli masih menjadi punca utama keperluan asas penduduk disini, penyelidikan mengenai peranan Amazon Peru sebagai sumber makanan telah dimulakan. Program penyelidikan perhutanan Amazon (AFRP) yang ditubuhkan pada 1987 telah memberi perhatian aktif kepada pemeliharaan hutan dan peranannya dalam menyediakan keluaran asas seperti makanan dan ubat-ubatan sebagai satu alternatif pembasmian hutan.

Introduction

"Rare species are disappearing, the forests are being destroyed rapidly in the Amazon". Statements like these are now common in the media. Never before in world history did the international press treat so extensively the Amazon problem as in the year 1990. But the flow of images and words are pushing aside a deeper and real analysis of the causes of this situation. In reality, political instability, economic difficulties (enlarged by rapid population growth), and the reinforcement of poverty and famine are forcing certain tropical countries to look for short-term profits using "western development methods" at any price. How could the respect for the forests and the environment in these conditions be sustained? In this paper, I shall dwell on some of the basic questions related to deforestation and the food problem in the Peruvian Amazon and how a new role of forestry research could provide a solution to these problems.

Food problem, poverty and deforestation

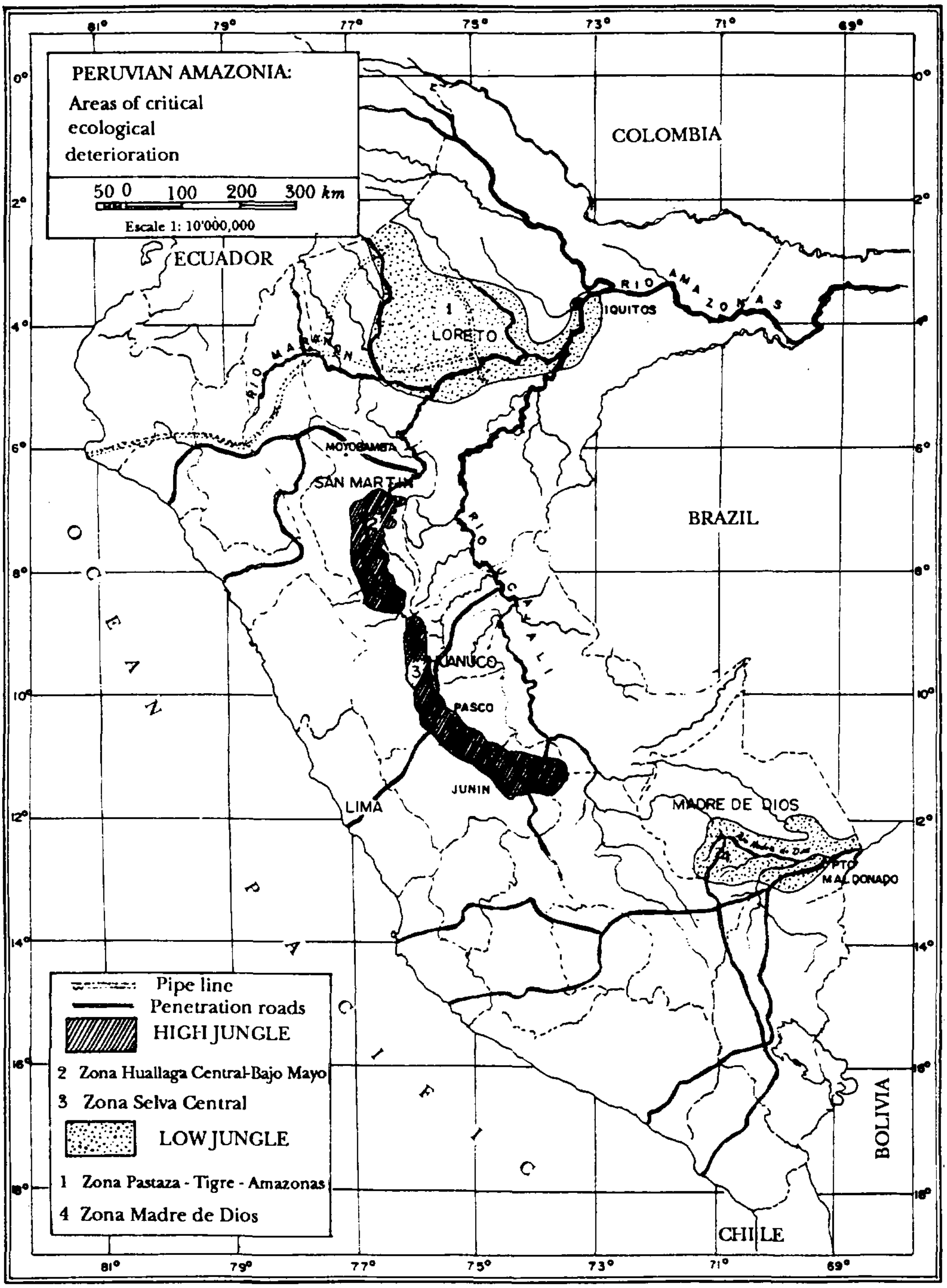
Peru, like many tropical countries, is in a very critical situation characterized by violence and environmental degradation. Many are the causes of this situation but poverty and malnutrition top them all. Peru's population by the end of 1990 was estimated at 23 million with a growth rate of 2.6%. The number of Peruvians below the critical poverty line increased from 37% in 1985 to 77% in 1990. More than 83% of the population (including the middle class) do not benefit from the minimum vital intake of calories and proteins, life expectancy is 57, child mortality under one year is 9%, and only 47% of the population have access to drinking water. (Chossudovsky 1991, Dubois 1991, Sasson 1990). A recent study indicates that the minimum salary in Peru is US$ 30 per month, the average salary US$ 45 to 60 per month and that in early 1990, the Peruvian economy sank to what could be the lowest point of a crisis like no other in the country's modern history (IDB 1991). Peru, like most Latin American States, imports large quantities of food products. Over 1.5 million tons of food consumed each year are imported. For example, the country imports 60,000 tons of oils and fats a year at a cost of US$56,000.

From 1980 to 1985, Peru spent US$ 2,566 million on food imports, approximately 12% of its total external debt (Ministerio de Agricultura 1987).

In front of these problems, a myth has been created about the Amazon, representing it as a vast territory, full of inexhaustible natural resources, that would permit Peru to solve all its current and future problems. The Peruvian Amazon with 900,000 km^2 (70% of Peru's territory) is considered a priority area for absorbing the flow of starving migrants from the Andes. The mistaken belief that the Amazon is Peru's pantry has generated great expectations for agricultural development, which up to now remain unfounded. The so-called "special projects" (10 in the Amazon, covering an area of 7.7 million *ha* and benefitting 11,000 families) were created on the basis of these expectations to encourage colonization and rural development.

However, reality is quite different because in the Peruvian Amazon rapid population growth and agriculture are the main causes of deforestation. At the end of 1990, the population of Peru's Amazon was estimated at 2.5 million and is expected to double by the year 2000 owing to inter-regional migration. This population is stratified in five categories from a cultural point of view and also from their perception and attitudes towards the forest.

The first group comprises the 250,000 Indians or indigenous people (10% of the Amazon population), corresponding to 60 ethnic groups whose subsistance shifting cultivation and forest extraction practices are not destructive to the forest environment. Some studies on the forest knowledge and the numerous species used by the Peruvian Amazon Indians indicate that the number of plant species used for food by the Aguarunas at the Cenepa river totalled 200;80 of these were cultivated and 120 were gathered wild from the forest (Berlin & Berlin 1979); and



Source: Ruiz Murrieta 1992

Figure 1. Peruvian Amazonia : areas of critical ecological deterioration

the Campas at the Gran Pajonal used 385 species of plants for food, medicine and other useful products (Denevan 1978).

The "ribereños" are the second group; they are 400,000 people (16% of the Peruvian Amazon population), living in approximately 2000 villages along the river's shores of the Amazon basin. The "ribereños" are of mixed Amazonian and European ancestry who make their living practicing shifting cultivation on upland forests, cultivating seasonally inundated low lying sites, hunting, fishing and extracting a variety of products, without harming the forest. Fruits from native trees such as pijuayo (*Bactris gasipaes*), umari (*Poraqueiba sericea*), shimbillo (*Inga* sp.), guaba (*Inga edulis*), caimito (*Pouteria caimito*), castana (*Bertholletia excelsa*), aguaje (*Mauritia flexousa*), uvilla (*Pouroma cecropiifolia*); crops such as rice, manioc, papaya, pineapple, cocona (*Solanum sessiflorum*); animal foods, forest fibres, handicrafts, charcoal and medicinal plants are among items obtained by the "ribereños" from the fields and the forest. (Denevan & Padoch 1987).

The third group are the 350,000 "coloños" (14% of Peru's Amazon population) of Andean origin, who have migrated into Amazonia through seven penetration roads connecting the three Peruvian regions: the Coast, the Andes and the Amazon. The "colonos", coming from a different cultural and ecological region (the Andes, where agriculture is the only way of getting food and natural forests are almost non-existing), do not see great value in the forests, and that is why they convert it in to agricultural land to raise cattle, and to grow in monocultures a few export oriented crops such as maize, soyabean, sorghum, cofee, cocoa and "coca" (approximately 300,000 *ha* in the Peruvian Amazon are being planted with coca for cocaine production), causing serious ecological harm to the forest, with deforestation and chemical pollution.

The fourth group are the people from "pueblos jovenes", shanty towns and the poorer parts of the cities. They are 850,000 people (34% of Peru's Amazon population), made up of Indians and "ribereños" who have settled in the cities of Iquitos and Pucallpa. They have thus ceased to be food producers but still depend on the forest for their basic needs such as food, medicines and construction materials. The last group are the 550,000 urban middle/upper class people (22% of the Peruvian population). The last group depend mainly on imported food and have a tendency to immitate the nutrition of industrialized countries.

At the end of 1990, the natural forests in the Peruvian Amazon covered an area of 737,000 km^2 (58% of the territory of Peru). During the last 50 years, 7.5 million *ha* of forest have been destroyed in the Peruvian Amazon due to agricultural practices not based on sound ecological principles, such as the one practiced by the "colonos". Each year 3000 km^2 of forest are destroyed by this group for forest conversion into agricultural land, and by the year 2000, 10% of the remaining forest will have been destroyed (Caufield & Zambrano 1985, Dourojeanni 1990). At present four areas of critical ecological degradation are apparent in the Peruvian Amazon: Huallaga Central-Bajo Mayo, Selva Central, Pastaza-Tigre-Amazonas and Madre de Dios (Figure 1), and a picture of deforestation, poverty and malnutrition is common in these four areas (Ruiz Murrieta 1992). So, during the last 50 years, the possibility of living in peace and harmony with the forest is threatened by a lack of alternatives to agriculture in increasing food production in the Amazon of Peru. While a handful of people pursue forest management for timber, thousands of other starving people destroy the forest for food production.

This contrasting situation has resulted in Amazon forests being viewed in such terms as a "barrier to food production", "an expansion frontier for agriculture development", "trees are not edible". Such phrases highlight the urgent need to seek ways of making possible the use of the forests as a food resource, and direct forestry and forest management to contribute to increase food production. The contribution that follows provides an example of the role of forestry research in this respect.

The past: ignoring forest food and indigenous knowledge

The prosperity of traditional Amazon husbandry in the past has been vividly described by the Jesuit missionary Gaspar de Carbajal during the expedition across the Amazon between 1530 and 1550 headed by Francisco de Orellana. Carbajal was impressed by the indigenous knowledge and ecological richness and diversity of the region: "The organization of the Indians and the abundance of food is admirable. We stopped in one Iquitos Indian village on the shores of the Amazon River; a milky drink made from manioc and bush meat were plentiful. Turtles were raised in large cages in swampy areas, and we ate lots of turtle eggs. The people were all employed in collecting the fruit of the "sacha mangua" (*Grias peruviana*), which is eaten as a vegetable cheese. To my palate this vegetable cheese is of a rich flavour and is the best cheese I have ever tasted apart from cow's milk" (Levistre 1982).

More than 450 years have passed since Carbajal described the food richness of the Amazon and now we find Peru and many other tropical countries suffering from poverty and malnutrition, whereas the silos of industrialized countries are full of surplus food products. The "sacha mangua" tree is still in its wild state, endangered, unselected and unknown to the world's planner of food development. This tree is a symbol of the decline and destruction of indigenous knowledge over much of the tropics. Its history can be repeated many times over for other food tree species throughout the Amazon. The "sacha mangua" tree had no significance in world markets in colonial times, and like many other comparable food trees, was ignored. All effort then and since has concentrated on commodities familiar in world trade and well known to western science (Roche 1989). A short analysis of agriculture and forestry research and development is a good exercise to prove this statement.

After independence in 1821, Peru underwent significant, externally defined changes in production patterns. At the cost of food production for the internal market, the successive governments forced the cultivation of export crops, such as coffee, cotton and cocoa. Agricultural production for the export market was seen as the basis of modernization and economic growth: it was agricultural exports that were to earn the foreign exchange needed to import capital equipment, raw materials and pay the external debt.

With the import of products like rice, wheat, cattle and poultry, consumption patterns changed in the Amazon to the detriment of forest food and traditionally grown food items such as those 120 plant species gathered wild by the Aguarunas and the native fruits produced by the "riberenõs" mentioned earlier. The last 50 years show that this agricultural export-led policy has met with increasing difficulties in the region. Both food production and research have failed to increase in parallel with population growth as shown from 414,452 people in 1940 to 2.5 million people in 1990.

In the Amazon, agricultural research started 25 years ago in a very disorganized way. A substantial number of research projects have been conducted by the National University of the Peruvian Amazon (UNAP); the National Institute of Agricultural Research and Promotion (INIPA); the INIPA and the North Carolina University (NCSU-USA) at Yurimaguas; and by the Ministry of Agriculture and the Swiss Technical Cooperation Agency (COTESU) at Jenaro Herrera.

Grillo (1988), in his analysis of 25 years of agricultural research in the Peruvian Amazon, noted that only seven plants were studied by INIPA, UNAP, NCSU and COTESU during this period, and in order of importance are the following: rice (*Oriza sativa*), pasture and forage, maize (*Zea mays*), soyabean (*Glycine max*), peanut (*Arachis hypogaea*), cow pea (*Vigna sinensis*) and sorghum (*Sorghum vulgare*). Five major aspects were studied on these plants: genetic improvement, response to fertilisation, cultivation practices (mainly density and sowing systems), mycology and weeds.

Grillo concluded that research done in the Peruvian Amazon to improve food production was completely unrealistic, and the culture and needs of the Amazon people were ignored, as was the universe of knowledge of indigenous people. The approach to the problem was totally agronomic, concentrated on an extraordinarily small number of species, with a strong power to replace and destroy, over much of the Amazon, the ecological basis of small scale, traditional farming systems such as that described by Carbajal.

This period of 25 years of agricultural research in the Peruvian Amazon has exposed both the underlying collapse of the ecological basis of indigenous agriculture in the Amazon and the inadequacies of an urban-industrial based Green Revolution with its limited options in crop production. Of the 6,000 plant species estimated for the Amazon of Peru, less than 1% are currently being used in modern agriculture. Because of this, a much narrower range of food and other plant products are available for local use, with a corresponding reduction in the self-reliance of the rural population. Caufield and Zambrano (1985) confirmed this statement; they recorded three major products of internal consumption in the Peruvian Amazon: rice (180,000 tons), maize (130,000 tons), and beans (10,000 tons); these last two staples, native to the Andes of South America, were introduced in the Peruvian Amazon at the beginning of the present century (Schwartz 1991).

Forestry and forest management in the Peruvian Amazon started 50 years ago without any coordination among the institutions involved. The first silvicultural experiments started in 1942 at the Experimental Station of Tingo Maria. Similar experiments then followed during the 50's in Yura and in Pucallpa carried out by the Ministry of Agriculture.

Since 1960, a number of research institutions as well as higher education centres for forestry have been created, that is the Faculty of Forestry at La Molina University in 1964, the School of Forest Technicians at Iquitos in 1965, and the Faculty of Forestry at the University of Iquitos in 1971. The major experiments on management and integral use of tropical forests as well as the first plantations were done from 1974 to 1980 at the Von Humboldt National Forest.

The major species studied during this period were: tornillo (*Cedrelinga catenaeformis*), caoba (*Swietenia macrophylla*), ishpingo (*Amburana cearensis*), yacushapana (*Terminalia* sp.), marupa (*Simarouba amara*), bolaina (*Guazuma crinita*), eucalyptus (*Eucalyptus camaldulensis*), melina (*Gmelina arborea*), pine (*Pinus caribaea*), cypress (*Cupresus lusitanica*) and teca (*Tectona grandis*). With respect to silviculture of plantations, the major aspects studied on these 11 species were: seed management, plantations of native species for timber production (tornillo, caoba, ishpingo, yacushapana, marupa and bolaina), and adaptation trials of exotic species (eucalyptus, melina, pine, cypress and teca). With respect to natural forest management, two major aspects were studied: growth comparisons in open fields and enrichment trials (IIAP 1985, Gonzales 1988).

Gonzales (1988), in his "Preliminary Diagnosis of Silviculture and Forest Management in the Peruvian Amazon", concluded that without any doubt the hundreds of projects and experiments that started almost 50 years ago, each one with its own approach, make the Peruvian Amazon an area rich in experiences and information. But all this effort was concentrated on species for "wood production" only, and forestry during this period was totally oriented towards urban development and the needs of the large wood industries.

An analysis of the theses presented for the degree of Forest Engineer showed that from 1966-1986 forestry research at the university level paralleled this trend and was oriented towards the development of timber plantations, consisting mainly of fast-growing exotic species, and the search for external markets (Mori & Gaviria 1987). Knowledge of wood potential was used to achieve a better industrial utilization, with emphasis on sawmill, plywood, and pulp and paper. Table 1, shows that a total of 215 theses were executed by the Faculties of Forestry at the Universities of La Molina (1966-1982), Huancayo (1966-1985), and Iquitos (1978-1986). From this total, 193 theses studied various aspects related to the forest for wood production and only 18 theses were on subjects different than wood. Silviculture of plantations was the area most studied with 50 theses, and these studies were concentrated on germination of seeds, studies of survival, fertilization of seedlings, plant production in nurseries, weed control and growth analysis. Within this area, 35 theses were dedicated to study *Eucalyptus* sp., 8 theses were on *Pinus radiata* and 1 study was devoted to melina (*Gmelina arborea*), three fast-growing exotic species. The native species most studied was cedro (*Cedrela odorata*).

The 29 theses on wood technology were devoted to study the physical and mechanical properties and wood anatomy. The studies on forest inventories with a total of 25 theses were concentrated on different sampling methods, volume tables and counting the timber resource. The University of La Molina devoted 15 theses to study the potential of various native tree species for pulp and paper production. Because only 18 theses were dedicated to study subjects different than "the forest as a source of wood": protected areas (8 theses), fruits (5 theses), wildlife (2 theses), argonomics, extension and remote sensing (3 theses), I conclude that university research neglected the demands of the majority of the Peruvian Amazon population (Indians, "ribereños", and "pueblos jovenes" people) who still depend on the natural forests to satisfy their basic needs, mainly food and medicines. The following aspects were studied on native fruits: seed germination of *Bactris gasipaes, Jessenia* sp., *Astrocaryum chambira,* and *Euterpe precatoria*; harvesting techniques of *Mauritia flexuosa,* and finally ecology and nutritional value of *Sambucus* sp. in the Mantaro Valley (Mori & Gaviria 1987, Ruiz Murrieta 1992).

Table 1. University forestry research orientation in Peru (1966-1986)

Research Areas	Number of theses			
	UNALM LaMolina	UNCP Huancayo	UNAP Iquitos	Total
Silviculture of plantations	9	33	8	50
Wood technology	12	15	2	29
Forest Inventories	12	10	3	25
Pulp and paper	15	3		18
Ecology of timber species	4	6	2	12
Wood preservation	3	4	4	11
Managerial economics of wood industry	2	1	3	6
Management of protected areas	4	2	2	8
Logging and wood transport	2	1	4	7
Lumber industry economy	5		1	6
Taxonomy of timber species	2	4		6
Forest fruits	1	1	3	5
Plywood	2		2	4
Derived wood products	2		2	4
Land classification and evaluation		4		4
Lumber	1	2	1	4
Forest entomology	2	1		3
Particle board	1	1		2
Wildlife management	1	1		2
Protection against water erosion		2		2
Forest pathology	1	1		2
Management of natural forests			1	1
Watershed management		1		1
Ergonomics	1			1
Remote sensing		1		1
Forest extension		1		1
Total	82	95	38	212

Source: Ruiz Murrieta (1992); UNALM (Agrarian National University-La Molina), UNCP (National University of the Center of Peru), UNAP (National University of the Peruvian Amazon)

The present: forestry research and food production

Despite the adverse changes that have taken place in the Amazon environment since Gaspar de Carbajal's time, rural and "pueblos jovenes" urban people in the region still depend on what is left of natural forest vegetation for many of their basic needs. The Amazon forest is potentially the most productive system under the tropical sun, although up to now it is the lesser known ecosystem in the biosphere. Research on the role of natural forests as sources of food is just beginning in the Peruvian Amazon (Ruiz Murrieta & Arostegui 1989).

In 1981, the Peruvian Amazon Research Programme (PARP) was created within the activities of the Instituto de Investigaciones de la Amazonia Peruana (IIAP), and in 1987, the PARP was transformed into the Amazon Forestry Research Programme (AFRP). The AFRP approach is the assessment and integration of the indigenous knowledge and local know-how, framed into a new scientific and technological policy based on the concepts of endogenous development as proposed by UNESCO. Research and development programmes now include those neglected plants traditionally valued by indigenous people. The programme is also ensuring the conservation of the natural forest estate and give greater attention to the role of forests in providing basic products such as food and medicines. The AFRP is a nationally based international programme of research, conservation of resources, information diffusion and training, and operates within the framework of the Amazon Cooperation Treaty (TCA) and existing structures for cooperation on Tropical Forests such as the FAO Tropical Forestry Action Plan, the UNESCO-MAB Programme and others.

Research

Besides the scientific infrastructure available in the Peruvian Amazon region, the IIAP has its own scientific infrastructure consisting of natural forests, experimental fields, laboratories, housing facilities, a documentation centre and a diffusion of information unit. This infrastructure is distributed throughout the Peruvian Amazon at the IIAP headquarters at Iquitos, the Jenaro Herrera Research Centre in the Ucayali River, the Quistococha laboratories near Iquitos and four decentralized scientific offices in Tarapoto, Chachapoyas, Pucallpa and Puerto Maldonado.

Research development and information activities directed at increasing the role of Amazon forests in providing food for local communities are concentrated in six main fields: wild phytogenetic resources, native fruit trees, native palms, agroforestry, development of community extractive reserves and diffusion of information.

One hundred and twenty-six forest inventories were carried out in the Peruvian Amazon from 1950 to 1984. The only information available from these inventories concerns the amount of wood per hectare and the number of timber species of economic value. Research into timber species started in Peru in a very intensive way in the early 1950s reaching its climax during the 1970's as a consequence of the commercial boom in many timber species coming mainly from the Amazon (IIAP 1985). As mentioned earlier, forestry during this period was totally oriented towards urban development and the needs of the large wood industries.

From 1982, the IIAP re-oriented the role of forestry towards rural and community development in the Amazon and now forest assessments are oriented to inventory plants with nutritional value and products other than timber.

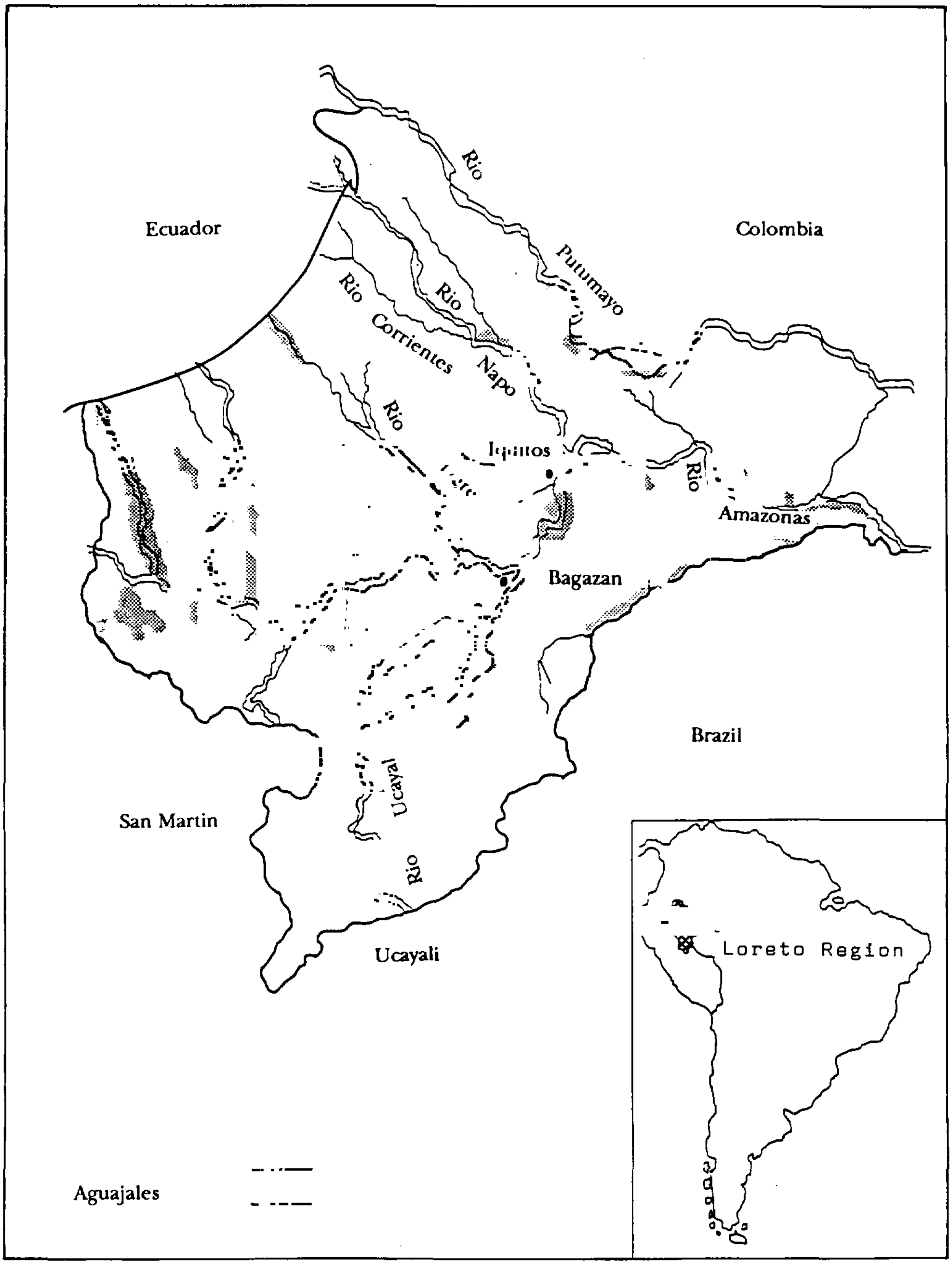
In the Peruvian Amazon, field assessments have shown that about 150 tree species are used by indigenous people for a variety of nutritional purpose. The IIAP's phytogenetic resource project was created to study the contribution of the Amazon plants to people's nutrition and to use them in selection programmes to improve the quality of cultivated plants. At the present time the project is concentrating on inventory, collection and conservation of about 20 wild native plants used for nutritional purposes, among them: achiote (*Bixa orellana*), guisador (*Curcuma longa*), jengibre (*Zingiber officinale*), dale dale (*Calathea allovia*), pituca (*Colocasia esculenta*) and witima (*Xanthosoma sagittifolium*).

In cooperation with the Institute of Economic Botany of the New York Botanical Garden (IEB-NYBG), research has been carried out on the taxonomy, ecology and nutritional value of 54 species of native Amazon fruit trees. Advanced information is available on the ecology of three of these native fruits: uvos (*Spondias nombin*), camu-camu (*Myrciara dubia*) and sacha mangua (*Grias peruviana*) as well as on recommendations for the sustainable management of their natural ecosystems. Finally, a study on the present contribution of forest food products to the Amazon economy was done showing the importance of the fruits of wild forest trees as food and employment sources, especially for the poor and women (Padoch 1987).

In the Amazon jungle of Peru, the palms constitute the main elements of the jungle landscape. There are some 1,300 species with a density of 5,625 ha^{-1} (Sist 1989). The palms are without doubt the most useful plants in the tropics, yet only a few species are used in an intensive way. They play a very important role in the Amazon economy, mainly as sources of food, but official statistics as well as Amazon silviculture ignore this resource. Although they present excellent prospects for increasing food production in the form of fruit, palm heart and edible oils, little work has been done in this regard. Ecological, biological as well as social, anthropological and economic research is done on these Amazon palms, in cooperation with ORSTOM (France).

At present there are excellent results on the following species: good for oils: ungurahui (*Jessenia bataua*), sinamillo (*Oenocarpus mapora*), poloponta (*Elaeis oleifera*); good as edible fruits: chambira (*Astrocaryum chambira*), pijuayo (*Bactris gasipaes*), aguaje (*Mauritia flexuosa*); good as palm hearts: huasai (*Euterpe precatoria*) (Kahn 1988).

Of these palms, aguaje makes the greatest contribution to the regional economy. It has a high nutritional value, is an excellent substitute for cow's milk (for its high protein, fatty acids, mineral salts and vitamin contents), and its fruit, like its other by-products, features in all aspects of the daily life of the Amazonian peoples. The aguaje grows in an homogeneous ecological system called "aguajales", which are swamp forests dominated by *Mauritia flexuosa*, at an average of 246 to 351 trunked palms ha^{-1}. In the peruvian Amazon the aguajales cover almost 8 million *ha* (Figure 2) (Ruiz Murrieta 1991).



Source: Ruiz Murrieta 1991

Figure 2. Location of the "aguajales" in the region of Loreto, Amazonia of Peru

Agroforestry research is done by the IIAP at its Jenãro Herrera Research Centre. Six agroforestry models are now being studied with advanced results. A previous socio-economic study of the Jenaro Herrera area provided information on the traditional systems and the plants being used by the rural and indigenous people as well as on their basic needs related to food, construction materials and medicinal products. The results of this socio-economic study indicated that palms play a major role as sources of food and construction materials and because of this, they are an important component in the six agroforestry models being studied, as shown in Table 2 (IIAP 1987).

Table 2. Traditional agroforestry models being used by the 'riberenõs' in Jenaro Herrera, at the Ucayali River (IIAP 1987)

Species	Agroforestry models					
	1	2	3	4	5	6
Wood trees:						
Tornillo (*Cedrelinga catenaeformis*)	x					
Huacapu (*Minquartia punctata*)						x
Food trees and shrubs:						
Uvilla (*Pouroma cecropiaefolia*)	x					
Guaba (*Inga edulis*)		x				
Cacao (*Theobroma cacao*)		x	x			
Umari (*Poraqueiba sericea*)						x
Araza (*Eugenia stipitata*)					x	
Camu-camu (*Myrciaria dubia*)				x		x
Palm heart and fruit:						
Huasai (*Euterpe oleracea*)			x		x	
Pijuayo (*Bactris gasipaes*)				x		x
Food crops:						
Plantain (*Musa* sp.)	x					
Manioc (*Manihot esculenta*)	x					
Cowpea (*Vigna unguiculata*)	x					
Rice (*Oryza sativa*)	x					
Pineapple (*Ananas comosus*)						x

Protected forests

In Peru, the National Network of Protected Areas is composed of 22 units that cover an area of 5.3 million *ha.* It includes seven national parks, eight reserves, four sanctuaries and three historical sanctuaries. Three related categories also exist: protected forests, community extractive reserves and hunting reserves. It is estimated that this network contains 2/3 of Peru's different ecological types and only part of its vast genetic pool (Ministerio de Agricultura 1987). In Peru's Amazon the extension of protected forests is 4.5 million *ha.*

The Historic Sanctuary of Machu Picchu, and the Manu National Park, both in the Peruvian Amazon, are cultural and natural world heritage sites respectively. The Pacaya-Samiria National Reserve in the low jungle near Iquitos (the largest in Peru, the second in Continental Amazonia and the fourth in extension in South

America) must soon be converted to Biosphere Reserve.

The IIAP is directly involved in building up and consolidating the Amazon network of protected areas, as well as in creating "community extractive reserves" for indigenous people as an alternative to slow forest conversion into agricultural and livestock lands, such as the one in Mishana near the city of Iquitos, where a recent study was done to prove that the best hope for the forests survival is to recognize that they are more valuable when left standing than cut (Peters *et al.* 1989). According to this study the most economically productive form of land use is long-term harvesting of non-wood products such as fruits, latex and medicinal plants. The cumulative values of harvest over 50y for four types of land use was calculated as a Net Present Value (NPV). The NPV of sustainable fruit and latex harvests was estimated at US$6,330 ha^{-1}; the NVP was US$490 ha^{-1} for timber harvest, a plantation of *G. arborea* was valued at US$3,148 ha^{-1} and the value of cattle ranching was US$2,960 ha^{-1} before deduction of costs of weeding, fencing and animal care. The results of this study will not, of course, be representative of all tropical forest areas, but provide a valuable basis for comparison, and they are important because they clearly demonstrate the importance of non-wood products. These resources not only yield higher net revenues per hectare than timber and cattle ranching, but they can also be harvested with considerable less damage to the forest. The Amazonia-Bagazan Programme (PAB) was recently launched within the framework of the twining between the cities of Triel in France and Bagazan in the Peruvian Amazon. The PAB will pay special attention to the non-wood resources as a means to achieve protection of Amazon forests.

Diffusion of information

The IIAP's success in this activity includes the production and diffusion of more than 50 television programmes on land use, environmental degradation and indigenous people; and more than 200 written scientific publications. A project named Food and Nutrition in the Peruvian Amazon was recently created by the MAB to diffuse the knowledge on the food obtained from forest trees as well as its nutritional, socio-cultural and economic values. The materials generated by this project will be used in environmental education. Finally, a joint initiative by scientists and indigenous people of the Peruvian Amazon will be soon launched to create a tropical forest "hero", a local cartoon character to inspire children to defend the forest and also to teach them that the preservation of the tropical forests will rely on the principle "not only wood but also food from the forest".

Conclusion

The protection of the environment and the improvement of the quality of life in developed countries is not only a concern of public opinion but also of politicians and industrialists. If in these countries the respect for the environment is a necessity, it is, on the contrary, a luxury in developing countries, too expensive to afford.

Poverty, hunger, rapid population growth, urban explosion as well as internal and external forces enlarge the barriers to protect the forest in developing countries. But these are not the only causes. The case of the Peruvian Amazon is a good example: education, research and development in agriculture and forestry were locked in conventional attitudes and policies that were determined by external needs rather than the needs of the local people, mainly the rural and the poor.

The lack of a sound endogenous development policy for the Amazon embarked Peru on a "western principle of development", which encouraged the country to enter a desperate race for economic growth, ignoring the real problems and venturing into agricultural and forestry research projects which did not take into consideration the ecological and cultural conditions of the Amazon.

The study on the agricultural research in the Amazon of Peru during the last 25y shows that all effort was concentrated on seven plants familiar in world trade and well known to western science. The same approach was applied to forestry research and management, a few timber species being the only products of interest.

In 1981, with the creation of the IIAP, a new type of approach to the Amazon problems was developed in Peru. IIAP efforts to attain development in the Amazon are immersed in the principles of "endogenous development", and on this basis a new research policy for the region was also created. Research and development programmes now include those plants traditionally valued by indigenous people and for many years neglected by modern agriculture. The new Amazon Research Programme is actively paying greater attention to the needs and demands of the mass poor with respect to basic products such as food and medicines, instead of giving importance to external needs. Food from the forest is a new approach to the food crisis being developed in the Peruvian Amazon as an alternative to deforestation and to develop sustainable land use systems in the Amazon in harmony with its cultural and ecological characteristics. A similar approach has already been developed for the tropical rain forests of Africa (Hladik *et al.* 1990).

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