CHAPTER V PRESENT CONDITIONS OF THE STUDY AREA

5.1 Natural Conditions

5.1.1 Topography

(1) Iranduba

The location of Iranduba differs from other municipalities in a sense that its region is situated between two rivers; the Negro and the Amazon River. Iranduba is located at the left bank of the Amazon River at a latitude south of 03°09'and west of Greenwich at 59°15' 3" longitude. It is accessible by ferry boat from the Negro river. Iranduba has an area of 2.354 km^2 and is 13 km from Manaus by road and 32 km by boat. It makes borders with Manaus, Manacapuru, Manaquiri, Careiro and Novo Airao. The geology of Iranduba is characterized by varzea and hard land (terra firme). Majority of its area is formed by a dense forest most of these on firm land area (terra firme) and is covered with tropical rain forest including Macaranduba, Samauma, Jacareuba, and Cedro.

(2) Itacoatiara

The municipal of Itacoatiara is located at the left bank of the Amazon River in east of the state. The area is 8.680 km^2 whose relative area to the state is 0.57%. The town is located at 3°8'54" latitude south and 58°25'00" west of Greenwich at longitude. It's straight line distance from the Manaus is approximately 175 km and 266 km by road. Ground level is 18 m above sea level. The Amazon River is utilized as the main water transportation network not only for local people but also for cargoes of beans produced in Matogrosso, Rondonia, and Goias. The predominant vegetation is the dense forest. The forest in the terra firme area is covered with tropical rain forest. However, it is observed that higher level deforestation was carried out in this area. The flat land area in varzea is constantly inundated by the rain water.

(3) Maues

The Maues municipal is located east of the Amazon state at a latitude south of 03°32'44" and west of Greenwich at 57°41'30" longitude. Ground level is 18 m above sea level and has area of 40,296 km^2. It's straight line distance from Manaus is estimated at 267 km and 356 km by river. Maues, like the majority of other cities in the lower Amazon, utilizes rivers as the main water transportation network for local people. In addition to the Amazon River, there are Urupadi River, Maues-Açu, Maues-Mirim, Andira, Paraori, Paraconi and innumerous rivers along the igarape area.

5.1.2 Characteristics of Land

(1) Varzea Area

Varzea, the area stretching to the Igapo, is a flooded area during the rise period of the Amazon River. The characteristic of the natural environment of Varzea is that the ground soil is fertile and the water level of the river change by the season. Agriculture flourished in the flooded area branches and at the riverbank in the Amazon River. The vegetation types in submersion and grassland are composed of mangroves and other woods. Suspended soil and clay substance from Terra Firme are accumulated in this area, which are carried by the river in the hinterland area by flood during the rise period. Alluvial ground is composed with fertile soil carried by this carriage mud. The Varzea forest and the Igapo forest which become flooded in the rise period are approximately 70,000 km^2 (55,000 km^2 low and flat land along the water course, 15,000 km^2 : swampland - Data source: IDAM Hand Book)

(2) Terra Firme

Terra Firme, the area following Varzea, is not flooded entirely. It is about 200 m in altitude. Some of the tree crowns reached as high as 40 to 55 m in search of light and the evergreen leaf flourishes well. Terra Firme area covered 3,303,000 km^2 of the plateau, which is 90% of the Amazon area and is not flooded in the rise period. The natural environment of Terra Firme is characterized by a very poor ground conditions. The temperature and humidity is high, and most of the areas are covered with indigenous forest. With the construction of Trans Amzonica Road, large scale slash and burn agriculture and deforestation was conducted which caused environmental disruption along this road. Almost all forest in this basin have poor ground conditions, and loses its fertility rapidly after cultivation as pasture in the deforestation field. At present, there are no farms in this area having good pasture with high productivity like the southern district of Brazil.

(3) Igapo

There are many rivers in the Amazon basin innumerably. The lowland along this river is named as Igapo. Most area is waterlogged land around the year but a lot of woods are present in this area. It is observed that there is wetland ecosystems and trees reaches 20m height, but most of height is 4 to 5m.

5.1.3 Geology

In general, the soil condition of the Amazon region including the expected project area is lean and not suit for cultivation because of its characteristics. Red soil with clay quality, which may have been placed in the Amazon region, is an acid soil with little nutrition contained. Also, there are soils with a lot of white sand in the northeast area of the Amazon. White sand soils are amongst the most infertile of the generally

infertile tropical soils. They are composed mainly of quartz sand, and support a distinctive vegetation. Data of white sand area is shown in Annex 5.1.3-1. The characteristics of forest soil data is shown Table 5.1.3-1.

Table 5.1.3-1 Forest Soil Data

Items	PH	N	C	Ca	Mg	K	P	Fe
Unit		%	%	Cmolc/dm3	Cmolc/dm3	Mg/dm3	Mg/dm3	Mg/dm3
Terra Firme	4.15	0.19	1.87	0.03	0.07	22.64	1.23	399.14
Igarape	4.22	0.12	1.89	0.07	0.07	26.93	3.33	57.33

Data source : J. Ferraz et al., 1998, (more than 5 cm of surface)

5.1.4 Meteorology

The basin area of the Amazon River is 6,500,000 km^2 based on the data of IBGE (The Brazilian Geography Statistic Board). Almost all area is covered by tropical rain forest, the annual rainfall in the basin ranges from 2,000 mm to 3,600 mm and the flow rate of the river is in huge volume. Table 5.1.4-1 shows record of water level on Amazon River.

Water level rises around January and reaches to a maximum level from May to June. The minimum water level rise can be observed from October to January. The average difference of the water level between the maximum and minimum is 9 to 11 m. Proposed scheme area in the northern part of the Amazon River basin is a tropical rain forest climate, and the temperature is ranges from 25 to 27 °C throughout the year, with a maximum of 37 °C. There are two seasons, the rainy season observed from December to May, and the dry season from June to November. The data of climate is referred to attached Annex 5.1.4-1.

Table5.1.4-1 Maximum and Minimum Water Level of Amazon River

Year	Maximum Level (m)	Date	Minimum Level (m)	Date	Difference
1980	26.00	Jul.01	17.68	Oct.08	8.32
1981	26.85	Jun.22	17.24	Nov.12	9.61
1982	28.97	Jun.22	18.28	Nov.02	10.69
1983	26.52	Jun.06	17.08	Oct.24	9.44
1984	28.03	Jun.18	19.58	Oct.31	8.45
1985	26.27	Jul.01	19.74	Nov.27	6.53
1986	28.14	Jul.16	21.40	Oct.13	6.74
1987	27.91	Jun.09	17.99	Nov.06	9.92
1988	27.78	Jun.29	17.82	Oct.12	9.96
1989	29.42	Jul.03	21.75	Dec.31	7.67
1990	28.23	Jun.17	16.32	Nov.02	11.91
1991	28.06	Jul.05	16.07	Nov.05	11.99
1992	25.42	May.20	17.56	Nov.11	7.86
1993	28.76	Jun.09	19.47	Oct.27	9.29
1994	29.05	Jun.26	19.06	Nov.26	9.99
1995	27.16	Jun.29	15.06	Oct.30	12.10
1996	28.54	Jun.19	19.14	Oct.19	9.40
1997	28.96	Jun.10	14.34	Nov.04	14.62
1998	27.58	Jul.05	15.03	Oct.30	12.55
1999	29.30	Jun.24	16.95	Nov.22	12.35

Data source: Amazon state observatory

5.1.5 Hydrology and Water Quality

(1) Hydrology

The source of Amazon River's huge water discharge affects the chemistry of ocean water over a thousand of km^2 through the transported sediments that builds up on distant shorelines and overspread remote seabed. The flow of the Amazon River causes sedimentation on the riverside, while inducing soil erosion of opposite shore in the downstream area. The shoreline of Varzea and Terra Firma area is scraped off and collapses due to the stream of the Amazon River. The earth caused by soil erosion is carried and accumulated downstream. The collapse phenomenon of land arises in the flooding period, and a large-scale collapse often arises along the river route. Survey data including the quantity of the earth and sand, which Amazon River system carried out for a period of one year is shown in Table 5.1.5-1.

Flow rate of Amazon River, being the biggest river basin in the world, is very large in volume compared with the other river basins. However quantity of dissolved substance which is transported to the ocean by river system is relatively low compared with others.

Table5.1.5-1 List of Water Quality

Name of River	Type of color	Quantity of Dissolved Substance		Quantity of Suspended Solid	
		Ton/km^2-year	Ton/basin-year(x 10^6)	Ton/km^2-year	ton/basin-year(x 10^6)
Ucayali	W	152.0	61.4	307.1	124.6
Maranon	W	92.8	37.8	251.5	102.4
Japura	W	10.9	31.6	120.2	34.7
Ica	W	17.0	2.5	61.9	9.2
Napo	W	29.1	3.6	184.0	22.4
Javari	W	11.5	1.2	68.3	7.2
Maderia	W	42.4	58.5	157.3	156.9
Jurua	W	33.2	7.2	49.4	10.7
Puras	W	30.3	11.3	43.2	16.1
Negro	B	10.0	7.5	10.1	7.6
Xingu	L	2.8	1.5	0.9	0.5
Tapajos	L	3.8	1.9	1.2	0.6
Main river	W	36.8	231.8	79.0	498.5

Data source: sternberg (1975) W: White River, B: Black River, L: Lighter River

(2) Water Quality

In general, the water of the Amazon River, is classified into three colors, each having different characteristic process and formation as follows:

- White color rivers (Solimoes, Amazonas, Madeira, Purus, Jurua)
- Black color rivers (Negro, Urubu)
- Lighter color rivers (Tapajos, Trombetas, Xingu)

The inclusion of water in this river has inherent characteristics as well as color, and has a big influence on the downstream area of the river. The soils and sands accumulated in the downstream of the river have different quality. For a productive and sustainable agriculture in this area, it is necessary to recognize the characteristics of these conditions. Chemical composition of the river water are shown in Table 5.1.5-2.

Table 5.1.5-2 Chemical Compositiof in the Water

Chemical Composition	Rio Negro	Rio Solimoes	Negro (trunk line)
pH	4.7	7.1	-
Electric cond.(μ s/cm)	8.3	58.7	14.1
KMn4-d (mg/l)	58.8	37.9	155.1
Ca^{2+} (μ g/l)	340.8	7240.0	4.7
Mg^{2+} (μ g/l)	178.4	1640.0	10.9
$NH4^{+}$ (μ g/l)	40.4	14.0	288.6
$NO2^{-}$ (μ g/l)	-	1.8	-
$NO3^{-}$ (μ g/l)	35.6	47.9	74.3
N total (μ g/l)	398.5	603.7	66.0
P total (μ g/l)	7.6	69.4	11.0
Fe total (μ g/l)	430.1	2700.0	15.9
CL^{-} (μ g/l)	1900.0	3500.0	54.3
SIO2 sol (μ g/l)	2600.0	3900.0	44.7

Data source : Ecosystem of the World 14B-Brinkmann W.L.F., 1989

a) White Color River

The “white river” is characterized with thin yellowish brown water, like the Solimoes River. The steep rivers in Andes mountains carry the weathered soils and sands downstream, which are accumulated in the western side of Amazon basin. The transparency of the white river is very low at approximately 10 cm to 50 cm deep. The water from the Andes mountain is rich in nutrition and is fertile, with an acidity (pH) between 6.5 to 7.0. The amount of calcium and magnesium is relatively high in comparison with sodium and potassium. The river creates wildlife habitats and a lot of fish live in this area. The area of river basin and accumulated area by White River is shown in Annex 5.1.3-1, as for the map of hydrography refer to Annex 5.1.5-1.

b) Black River

The color is very dark similar to a coffee, like the Negro River is called “black river”. The water source of the Negro river borders on the Orinoco river which flow to the northern direction of Venezuela. The Igapo forests are stretched in the area, which these two rivers are close to. In Igapo area, the rainwater flows freely and the border of watershed is not clear. The river is characterized by the low contents of nutrition and high acidity (about pH 3.8 to 4.9). A coffee-like color is caused by the presence of small organic particles. However, the transparency of the river is high and approximately 3 m deep can be seen. This type of water can be found in the vast extent area of the river along the Igarape in the upstream.

c) Green River

The water of the Tapajos River contained little amount of small organic particles and the transparency is high at more than 4 m deep. The water source of “green river” is Brazil Plains , which is formed by old and hard crystal rock with a gentle topography. The soil erosion caused by rain in this area is small. Therefore, the river contained less minute particles and retains high transparency. The acidity of this river is pH 4.5 to 7.8, which indicates alkaline water.

5.2 Environmental Aspect

5.2.1 Ecology, Fauna and Flora

(1) Ecology of Amazon

The Brazilian Amazon contains the largest humid tropical rain forest in the world, acting as a major carbon reservoir. The rainforest and associated aquatic ecosystem contain some of the world's highest biological diversity in terrestrial and aquatic plant and animal life of which many are known, and presumed, to be useful natural products. The Amazon River contribute some 20% of the global fresh water river discharged into the world's ocean. Conservation of the Amazon's natural ecosystems and functions is of great importance to the local people and to the world at large.

Extinction of the species is progressing at a high speed, which was not experienced since the beginning of the earth's history. It is said that reducing of the wet lands and tropical rain forest causes serious impact to ecology, and the reason for the rapid extinction of the species are a product of human activity not through natural process. It is said to, that the extinction of the species is going on rapidly, causing significant impact to the decrease of the tropical woods and the marshlands. In the survey report of International Union for Conservation of Nature and Natural Resource (IUCN), it is expressed that the reason of extinction results in i) Subversive activities and change for the worse of the living environment, ii) Over catching, iii) Inference of invasion by other species, iv) Shortage of foods, v) Over cropping and livestock as assailant, vi) accidental catching and so on. Decreasing of humid tropical forest gives significant impact to species extinction, and it is said that decreasing the areas of tropical forest by 1/10, biodiversity will be become half. One of characteristic of humid tropical forest is narrow distribution of species, however there are no survey data in scheme area presently. It is planned that these data will be prepared by PPG7 project in the future, which is conducted by IPAAM and related organizations.

(2) Fish Fauna

The Amazon River is characterized by having one of the richest aquatic bio-diversity in the world. More than 2500 species or about 20% of world freshwater fish species have been recorded in this river system (Table 5.2.1-2). They are classified taxonomically into three major fish groups namely the orders of characiformes, siluriformes and perciformes, and one specific order osteogrossiformes. Important species on capture fishery in the Amazonas State are enlisted in Annex 5.2.1-1.

Table 5.2.1-2 Comparative size of world and Amazon freshwater fish fauna.

Order	World			Amazon		
	Families	Genera	Species	Families	Genera	Species
Lepidosireniformes	2	2	5	1	1	1
Lamniformes	1	1	1	1	1	1
Rajiformes	3	9	70 *	2	2	12
Osteoglossiformes	6	26	206	2	2	4
Clupeiformes	4	68	331	2	12	17
Characiformes	15	252	1,335	12	229	1,200
Siluriformes	31	400	2,211	14	235	1,000
Gymnotiformes	6	23	54	6	23	54
Batrachoidiformes	1	19	64	1	1	1
Cyprinodontiformes	13	120	845	5	13	30
Synbranchiformes	1	4	15	1	1	1
Perciformes	150	1,367	7,791	6	50	350
Pleuronectiformes	6	117	538	2	2	5
Tetraodontiformes	8	92	329	1	1	5
Total	247	2,500	13,795	56	573	2,681

*: Not all freshwater

Source: Val and Almeida-Val (1995)

Remark: Important fish groups in fishery is highlighted

5.2.2 Protected Fauna and Flora

Osteogrossiforms is often introduced as an ancient fish group being a symbole of Amazon fishes. It comprises of only two genara namely Arapaimidae represented by pirarucu, Arapaima gigas and Osteoglossidae represented by aruana, Osteoglossum bicirrhosm. Pirarucu is one of the items aimed for investigation in this survey. They can be found in the whole area of the Amazon basin from the downstream Marajo island to Peru in the upper stream of the Amazon River. This fish live in the fen area along the branch of the Amazon River. At present, the number of the fish inhabits in these areas decreased sharply due to the development of modern fishing method and indiscriminate fishing. Pirarucu and aruana are listed as an endangered species in CITES Ⅱ(Convention on International Trade in Endangered Species of Wild Fauna and Flora) of the Washington Convention and is protected by law in Brazil. Exportation and catching are fully prohibited by the law. In principle, catching of less than 150 cm in size is prohibited and completely forbidden during the breeding season. In Brazil, there are 182 kinds of endangered species and 371 kinds of vulnerable species listed in Red Data List of International Union for Conservation of Nature and Natural Resource (IUCN). Table 5.2.2-1 shows list of fauna and flora in Brazil.

Table5.2.2-1 List of Fauna and Flora in Brazil

Items	Total Species	Treated Species
Mammals	394	45
Plant	55,000	463
Bird	1,635	103
Reptile	468	10
Amphibian	502	1
Fresh Water Fish	2,686	8

Source: World Resources Institute / Val and Almedia - Val

5.2.3 National park and Reserved Area

It is said that one third (1/3) of the rain forest in the world originates in the Amazon River basin, and the tropical rain forest area of the Amazon state is estimated about 1,559,000 km^2 according to the statistics report by INPA. There are three type of

reserved parks in Amazon state such as; ⅰ) Federal Conservation Unit, ⅱ) State Conservation Unit, ⅲ) Municipal Conservation Unit.

Information of location of reserved areas, category of area, and data of national park and reserved area are shown in Annex 5.2.3-1, 5.2.3-2, 5.2.3-3, and 5.2.3-4. In the subproject of PPG7, park and reserves project are being carried out presently. The project is aimed to contribute to the protection of the environmental heritage, through conservation of the biodiversity of the Brazilian tropical forest. The project objective is to be accomplished through providing incentives for the integration of public and private conservation unit as well as orienting and ordering the use of natural resources of ecology in Amazon region. Specific object of the Park and Reserves Project are the following;

- To implement model conservation units in priority bio-diversity conservation areas and expand the national system of conservation unit
- To encourage expansion of the system of private natural heritage reserves (RPPN) and
- To conserve large blocks of tropical forests

5.2.4 Deforestation

Forest provides important global environmental protection such as repository of biodiversity, carbon sink, and protection of floodplain of Amazon River. Attention has been focused in recent years on the degradation of large areas through forest to pasture conversion, slush and burn agriculture, logging, mining and fires. According to the statistics record prepared by FOA (Food and Agriculture Organization of the United Nations), 1,277,000 ha of tropical rain forest has disappeared from 1990 to 1995 in Brazil. Table 5.2.4-1 shows data of deforestation by states, Table 5.2.4-2 and Figure 5.2.4-1 shows wood extraction in the Amazon. There are many reasons and degrees of deforestation according to the regions. It is very difficult to completely suspend the continuous disappearance because it has close and complicated relationship with the local economy, and the local society in particular. The areas, which are expected in the scheme, are low-lying lands along the Amazon floodplain and tributaries.

Table 5.2.4-1 Data of Deforestation by State

Unit : ha/year

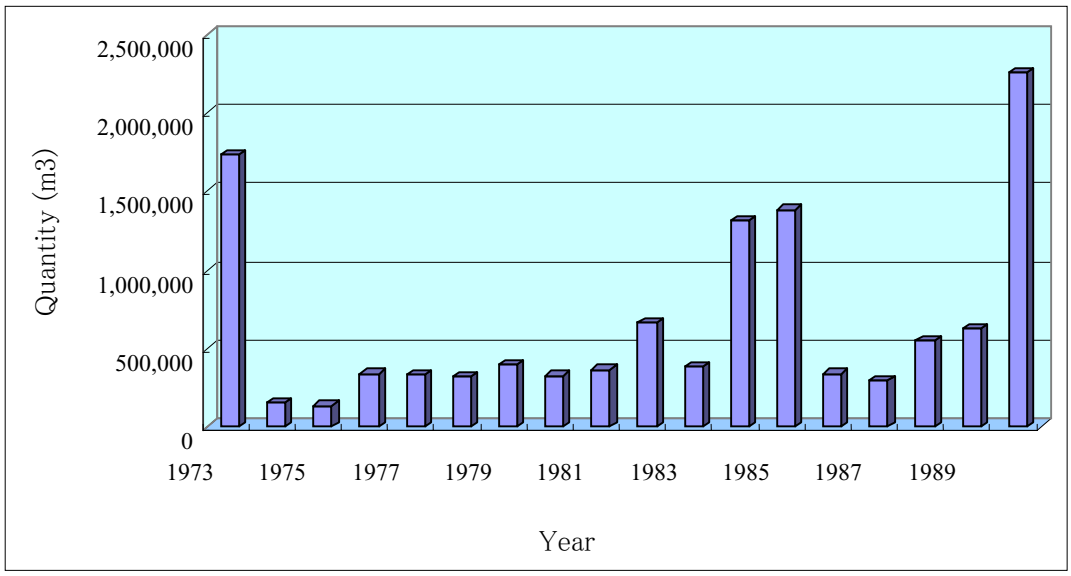
States	1977/ 88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/ 95	1996/97	1997/98
Acre	620	540	550	380	400	482	1,208	433	358	536
Amapa	60	130	250	410	36	-	9	-	18	30
Amazonas	1,510	1,180	520	980	799	370	2,114	1,023	589	670
Maranhao	2,450	1,420	1,100	670	1,135	372	1,745	1,061	409	1,012
Mato Grosso	5,140	5,960	4,020	2,840	4,674	6,220	10,391	6,543	5,272	6,466
Para	6,990	5,750	4,890	3,780	3,787	4,284	7,845	6,135	4,139	5,829
Rondonia	2,340	1,430	1,670	1,110	2,265	2,595	4,730	2,432	1,985	2,041
Roraima	290	630	150	420	281	240	220	214	184	223
Tocantins	1,650	730	580	440	409	333	797	320	273	576
Total	21,050	17,770	13,730	11,030	13,786	14,896	29,059	18,161	13,227	17,383

Data Source : INPA 1998

Table 5.2.4-2 Wood Extraction in the Amazon

Year	Quantity (m^3)	Year	Quantity (m^3)
1973	1,732,112	1982	662,725
1974	153,164	1983	384,646
1975	135,861	1984	1,316,589
1976	338,886	1985	1,382,218
1977	330,603	1986	339,948
1978	317,411	1987	292,252
1979	398,376	1988	552,000
1980	325,013	1989	626,011
1981	364,176	1996	2,255,311

Data source : Edicao SEBREA



Data source : Edicao SEBREA

Figure5.2.4-1 Wood Extraction in the Amazon

It is said that the main reason of disappearance of humid tropical rain forest are considered and inter-related with the historical situations such as i) road construction work, ii) increment of immigrant, iii) expansion of farm land including stock farm, iv) slush and burn agriculture by small farmers, v) extraction of wood, etc. It is considered that these problems such as increment of population and poverty will remain to be a major factor in contributing to the tropical rain forest's continuous disappearance. Disappearance of tropical rain forest has close relations with the local inhabitant living in this region. Most of the fires that occur during the Amazon dry season, are caused by farmers and ranchers burning off cleared land to plant crops or renew pastures. Since 1970s, larger and larger areas of land were cleared at once for pasture, plantation crop and infrastructures. History of changes regarding to ratio of preserved areas are shown below.

Year	Ratio of Preserved Area
1965	50%
1996	80%
2000(proposed)	50%

Federal Law - number 4,771/65, about Brazilian Forest Code, says that the owners of lands must preserve at least 50% of the area in original state, in other words, 50% of the area has to be original forest. Therefore, half part of the

properties, could be used to farming and cattle raising. However, after the edition of the Provisory Measure – number 1,511/96 by Brazilian Government, the minimal area to be preserved by the owners of the lands turned to be 80% of the total area. Data of deforestation is shown in Table 5.2.4-1. Data of wood extraction is shown in Table 5.4.2-2 and Figure 5.2.4-1. As for the location of higher level deforestation are shown in Annex 5.2.4-1.

5.2.5 Indigenous People

The indigenous population of Brazil consists of approximately 326,000 persons, distributed among 215 ethnic groups spread practically throughout the entire national territory. Majority is concentrated in the Amazon region. At present, certain groups still live in relative or complete isolation.

There are reserve areas for indigenous people located approximately 200 km far from the central part of the Maues. Approximately 5,800 indios live in this area. Table 5.2.5-1 shows data of Indio population in the study area. They cultivate guarana and sell those products since the start of cultivation several decades ago. Indigenous people live in this area starting cultivation of guarana faster than immigrants. Even at present stage, they are cultivating and selling products in Maues. According to this situation, IDAM is planning to carry out a technical assistance to be conducted 4 to 5 times in a year for training of indio in the reserved area.

Table 5.2.5-1 Data of Indio Population in the Study Area

Name of Land	Municipal	Population	Area (ha)
Satera mawe	Maues	5,825	788,528
Parana do Arauato	Itacoatiara	103	5,763
Rio Urubu	Itacoatiara	374	27,140

Communities of new immigrant live far from the reserved area, and no troubles between both communities are reported at present stage. FUNAI and IDAM are supporting the indio's society as part of the government activity. Map of indigenous people's land in Amazon is shown in Annex 5.2.5-1.

5.2.6 Soil Erosion and Deterioration

In the humid tropical rain forest, large number of small farmers carried out cultivation in terra firme area. In most places the traditional farming system for these small farmers has been swidden or shifting cultivation. Under this system of slush and burn, farmers cut and burn a forest and then cultivate the plot for two or three years. After this time, the soil fertility would decline, weeds would become a problem and yields would eventually drop. The farmer would then abandon this plot and clear a new one. In the absence of adequate conservation safeguards, traditional method of cultivation on steep slopes under heavy and intense rains usually lead to very serious soil erosion. Soil erosion and degradation results in the loss of production and loss of income. In the tropical rain forest, 95% of the annual rainfall are reserved or stored in the earth, preventing soil erosion.

At the tropical rain forest, the organic and the inorganic matter, which are produced by the forest is accumulated as vegetable lodgment. It is thought that such lodgment do not flow to the flowing effluent and ground water. When slush and burn agriculture is carried out, plants and accumulated vegetable lodgment, which are preserved by the forest ecosystem becomes ashes with fire, which causes depression of the ecosystem. As a result of deforestation, increased ground erosion at the onset of the rainfall will be expected. The ground nourishment that has accumulated in soil by forest ecosystem for many years disappear within only several years and its recovery becomes very difficult. The quick growth of vegetation in the humid tropics greatly assists erosion control. However the protective advantage of vegetative cover offered by cover cropping, green manuring, etc. have not been widely used by small farmers as yet.

5.2.7 Soil Sedimentation

In the varzea area in the floodplain of the Amazon River, flooding occurred regularly in every year. As the result of this flooding the river carries the fertile soil from upper area. Thus, farming style in which utilization of this fertile soil considered as blessings of the river, is established in varzea area until now. The basin of the Amazon River having the characteristics of water quality caused by soil erosion and flooding, has given significant influence to varzea area where it is expected in this project. In addition, flooding of riverbanks that are generally fertile by means of natural irrigation and nutrients brought by the rivers and subsequently absorbed by the soil. These conditions of soil sedimentation made significant impact to Amazon's farming style historically. In case of conducting agricultural project in the future, it is expected that this situation of farming style might be continued in the future.

5.2.8 Change of Vegetation

The land area planted per holding of targeted farmer in the scheme area is approximately 5 ha according to the RRA and Questionnaire survey report. These farmhouses supported by PRONAF and targeted in this scheme, is a very small-scale in Brazil. Also, average ratio of land utilization is estimated at 10 to 20 %. Due to the small scale of cultivation, the environment in the humid rain forest in the scheme area is preserved presently. It is observed that small farmer depend on family labor in proceeding with the traditional farming such as slush and burn agriculture. These situations of farming are completely different compared with the large-scale farmers. In case of proceeding with the cultivation of medicinal plant and tropical fruits, the field will be utilized continuously. Thus, except for large expansion of agricultural field, it is not required extending of slush and burn agriculture. Basically, JICA Study Team's recommendation is not necessarily to increase the field by slush and burn methods. Therefore, it is foreseen that when proceeding with the agroforestry in the area, the change of vegetation is not expected to occur. The disappearance of the

humid tropical rain forest by cultivation is estimated to be small scale and limited area.

5.2.9 Evaluation of IEE

In this study, evaluation of IEE is conducted on the selected 47 environmental items according to JICA's Standard Form, and its results are shown in Table 5.2.9-1. Table have unknown factors, and it is foreseen that small impact to the natural and social conditions will be caused. Proposed agriculture has a potential to slow down the tropical deforestation; and it can extend the period of agricultural production in already cleaned area, thus reducing the need to clear more humid rain forests. Among the selected environmental items caused by the proposed project, marked "B" (Impact is not clear and identification is required) are as follows: 1) Rare species of fauna and flora, 2) Soil erosion. At present stage, location and conditions of proposed Agricultural Plan is not yet finalized. However it is required that the project execution plan in the future shall be prepared in consideration of the above described items, result of IEE and site survey of local inhabitant's intention. In this scheme, official EIA is not required, however it is recommended that the project activities that have potentially negative environmental impact would be identified in the next stage or implementation stage of the project.

Table 5.2.9-1 Result of IEE

Ⅰ. Social Environment

Items of Environment		Evaluation of IEE		
No.	Items to be Checked	Itacoatiara	Iranduba	Maues
1.	Social/Community Life			
(1)	Daily life of inhabitants			
1	Planned Resettlement	X	X	X
2	Compulsory resettlement	X	X	X
3	Changes in mode of living	P	P	P
4	Conflict among villagers	C	C	C
5	Presence of ethnic minorities	X	X	X
6	Immigrants	C	C	C
(2)	Demographic Issues			
1	Population increase	C	C	C
2	Drastic change in demographic composition	X	X	X
(3)	Economic activities of local residents			
1	Transfer of economic activity base	P	P	P
2	Diversion of activities, unemployment	P	P	P
3	Widened income disparity	C	C	C
4	Diversity of income generation	P	P	P
(4)	Social institutions and tradition			
1	Readjustment of water & fishing right	X	X	X
2	Change in social structure/organization	C	C	C
3	Renovation of existing institutions	C	C	C
2.	Health and Hygiene			
1	Increased doze of agro-chemicals	C	C	C
2	Incidence of indigenous diseases	C	C	C
3	Prevalence of contagious diseases	X	X	X
4	Accumulation of residual toxicity	X	X	X
5	Increasing wastes and excretes	X	X	X
3.	Historical Monument, Cultural Heritage, Landscape, etc.			
1	Damage and destruction	X	X	X
2	Lose of unique/precious landscape	X	X	X
3	Influence to buried resources	X	X	X

II. Natural Environment

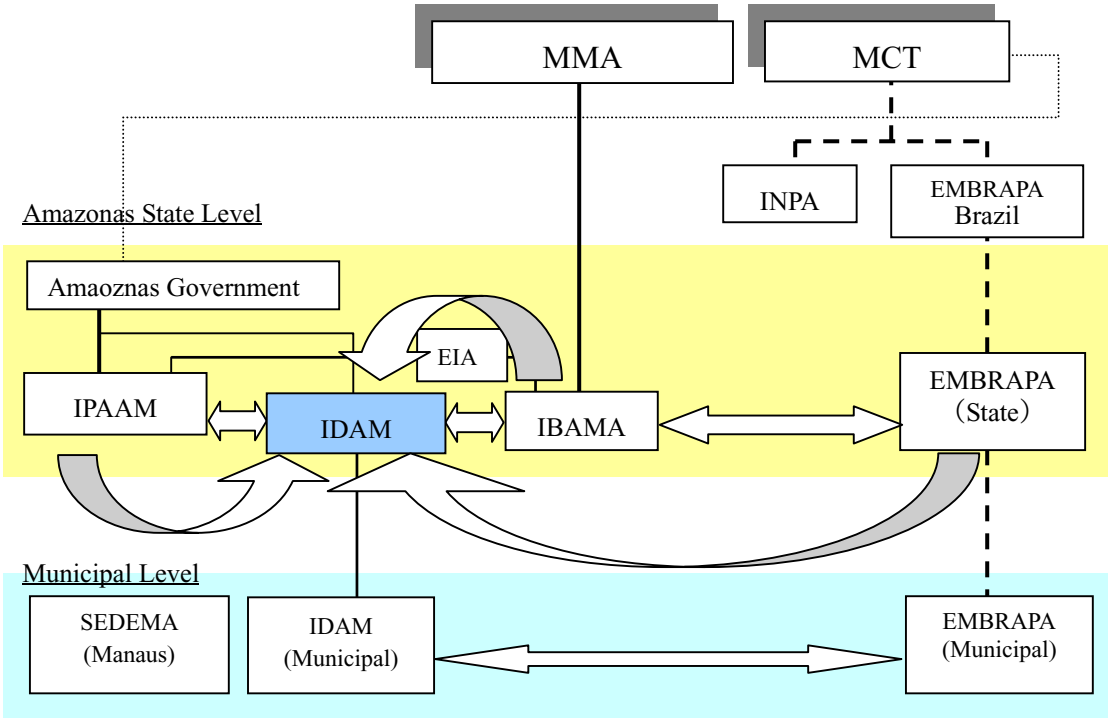
No.	Items of Environment Items to be Checked	Evaluation of IEE Itacoatiara	Iranduba	Maues
4. Rare Species of Fauna and Flora				
1	Change in vegetation	C	C	C
2	Influence to rare species and fauna and flora	B	B	B
3	Degrading biodiversity	C	C	C
4	Invasion/proliferation of harmful	C	C	C
5	Extinction of marsh land	X	X	X
6	Degradation of natural forest	C	C	C
7	Increased incidence of forest fire	C	C	C
5. Soils and Land				
1	Soil erosion	B	B	B
2	Soil salinization	X	X	X
3	Loss of soil fertility	C	C	C
4	Soil contamination	X	X	X
5	Land degradation/deterioration	C	C	C
6	Incidence of collapsed topography	C	C	C
7	Subsidence of land	X	X	X
6. Hydrology, Water Quality etc.				
1	Change in behavior of surface	C	C	C
2	Change in underground water level	X	X	X
3	Incidence of flood and drought	C	C	C
4	Accumulation of sand and silt	C	C	C
5	Subsidence of river bed	X	X	X
6	Contamination of water quality	X	X	X
7	Eutrophication	X	X	X
8	Change in water temperature	X	X	X
9	Air pollution	X	X	X

Note
A : Possible negative impact for which assessment is necessary through site surveys
B : Impact is not clear and identification is required
C : Relatively low magnitude of impact is expected
X : No effect is expected
P : Positive impact is expected

5.3 Environmental Management

5.3.1 Environmental Organization

As for the environment administration in Brazil, the Ministry of Environment, Hydroric Resource and Legal Amazon is activated as the main concerning Ministry. There are three sub-organizations tasked for environment administration under the said Ministry (CONAMA: National Environment Council, IBAMA: Brazilian Institute of Renewable Environment Resource, LAA: Legal Amazon Affairs). The organization concerned with provincial government level includes IPAAM and IBAMA and they carry out the environment administration in the Amazon state. Moreover, there are organizations at a city level including SEDEMA, IDAM and EMBRAPA under the state organization. The IDAM and EMBERAPA are activated as related organization of this project. The organization chart of these administrative systems is shown in Figure.5.3.1-1



MMA	Ministry of Environment, Hydric Resource and Legal Amazon
MCT	Ministry of Science and Technology
IBAMA	Brazilian Institute of Renewable Environment Resource
IDAM	Institute of Agricultural and Livestock Development of the State of Amazon
IPAAM	Institute of the Environment Protection for the Amazonas State
SEDEMA	Secretary of Environment of Manaus
EMBRAPA	Agroforest Research Center of Ocidental Amazon

Administration of Environment
Research
Administration of General
Coopeartion
Required Data & information transfer
Required Data & information transfer

Figure 5.3.1-1 Environmental Organization for the Project

IPAAM is responsible for the administrations regarding the Environment Impact Assessment in the Amazon state, and IBAMA provide comments and assist in the evaluation of the EIA report submitted by applicants. However, EIA report has to be basically submitted to both organizations for parallel evaluation. At present, all kinds of EIA for the various projects that are planned in the Amazon states are controlled and approved by IPAAM.

The PPG7 project being carried out at present are controlled by MMA in Brazilia. However, one of the sub-project, PGAI office was established under the IPAAM and they are conducting activity as the main organization of PGAI. The organization chart of IPAAM, IBAMA, and PGAI are shown in Annex 5.3.1-1, 5.3.1-2 and 5.3.1-3 respectively.

5.3.2 Procedures of EIA

Basically, there are no Initial Environmental Examination (IEE) system legally required in the Amazon state. It is therefore requested that the examination of its potential influence, which can cause impact to the environment shall be conducted by EIA. Regulations of EIA for the agricultural development related to this project is prescribed in the environmental law issued by MMA. The size of development required by EIA is more than 100 ha per each developer (farmer). Basically the EIA is not required in this project according to Environment Law. The procedure of the EIA in the Amazon state is shown in Annex 5.3.2-1.

5.3.3 Environmental Licensing System

There is a licensing system in addition to the Environmental Impact Assessment (EIA) system. The IPAAM is the state environmental organization responsible for licensing system according to the Government law (No.1532, July 6,1982, No.1642 May 22, 1984, and No.8812 July 26,1985). According to the above laws, the project which includes the following activities have to prepare application for obtaining the license;

- Vegetal extraction and mineral extraction and treatment;
- Industries, agriculture, cattle raising, hunting and fishing;
- Any activity or system involving collecting transport, storage, treatment or disposal of any solid, liquid and gaseous residue;
- Construction and installation of crawl pier or airport, power plant installation, road construction, hydro resources development;
- Hospital, laboratories;
- Activities involving solid, liquid and gaseous combustible;
- Activities involving combustion of trash or residue solid, liquid, gaseous;
- Activities that may affect the nature beauty, archeological and geological reserve;
- Activities that may affect the aquatic ecosystem;
- Zoning for development
- Activities regarding to the use of hazardous materials and storage
- Others activities that IPAAM may consider potentiality impact to the environment.

After the evaluation of the application, three types of licenses will be issued by IPAAM as followings;

(1) LP (Previous License)

This license is issued on the 1st phase of the project with the basic requirement of municipal site like location, installation operation, observing state and federal requirements for the use of the land.

(2) LI (Installation License)

This license is issued to authorize the beginning of the project implementation, according to specifications of the approved project.

(3) LO (Operation License)

This license is issued by IPAAM for the commencement of operation, as well as the functioning of equipment, after IPAAM has checked and confirmed everything is in accordance with the LI. In case of the licenses (LP, LI and LO) expires, the applicant have to contact IPAAM for renewal.

Basically, applications are submitted to IPAAM, and the applicant is required to obtain information regarding his registration with SELAPI (State Licensing System for Activities involving Environmental Impact). After the solicited documents are issued to IPAAM, site conditions will be evaluated and checked by IPAAM to verify compliance to the regulations.

5.3.4 PPG7

(1) Type of PPG7 Project and Objectives

The Pilot Program to conserve the Brazilian Rain Forest was created to protect the biodiversity of the Amazon and Atlantic Forest, reduce carbon emissions, promote the improved quality of life of local populations, and provide experience in international cooperation on global environmental issues. It is designed to develop, test and learn from opportunities to maximize rainforest environmental benefits while being consistent with Brazil's development objectives.

The Program was first proposed by the German Government in 1990 at a G-7 meeting in Houston, USA. Formulated in 1991 and established in 1992, it is a joint effort of the Brazilian Government, the G-7 and Dutch Government, and the Commission of European Communities, broadly supported by their civil societies. Basically, the PPG7 project is aimed for the following objectives according to data of World Bank.

- Demonstrate that sustainable economic development and conservation of the environment can be pursued at the same time in Brazilian tropical rain forest.
- Preserve the biodiversity of the Brazilian tropical rain forest.
- Reduce the rain forests' contribution to the world's emission of greenhouse gases.
- Set an example of international cooperation between industrial and developing countries on global environmental problems.

Annex 5.3.4-1 shows the title and objectives of subprograms for PPG7 project and Annex 5.3.4-2 shows the institutional structure of the PPG7. The project objective is intended to protect the forest and to promote a sustainable development of Brazilian tropical rain forest that will meet the need of the current generation without compromising the future generation.

The subprogram of the PPG7 is a structural project, the purpose of which is to obtain satisfactory results, which may be applied institutionally in the consolidation of Brazilian environmental policy and the expansion of knowledge of Amazon

ecosystems for the sustainable use of natural resources. Natural resource subprogram (SPRN) consists of six basic projects as follows;

1) Extractive reserves
2) Protection of indigenous lands and populations in the legal Amazon Region
3) Support for forestry management in the Amazon region
4) Management of the natural resources of the floodplains
5) Parks and Reserves
6) Monitoring and control of deforestation and burnings in the Amazon region

(2) Ecological and Economic Zoning

At present, the Amazonas state government is implementing an Ecological and Economic Zoning （EEZ）project. EEZ project is one of the activities of the Integrated Environmental Management Project (PGAI) in coordination with IPAAM, and EEZ is a subprogram of the Natural Resources Policy Subprogram (SPRN), which is part of the PPG7. EEZ project received technical support from German Technical Cooperative Agency (GTZ). Annex 5.3.4-3 shows the existing organization and the flow of EEZ project. Annex 5.3.4-4 shows the organization for Implementation of the EEZ project prepared by MMA. The EEZ program for the Legal Amazon Region established by the federal Government in 1991, are defined as follows:

- EEZ is one of the instruments for rationalization of the occupation of space and the redirecting of activities, a contribution to strategies and actions for drawing up and execution of regional plans aiming at sustainable development.
- The purpose of EEZ is to give the government a technical basis for spatial distribution of public policy, with a view to territorial ordering.
- For its part, territorial ordering is understood as the spatial expression of economic, social, cultural and ecological policy.

The concept of the ecological-economic zoning combines two basic dimensions: the ecological which reflect the limits and potential for sustained use of natural resources and the economic which express for human development of the communities that inhabit the territory and rely from it for their sustenance.

(3) Background of EEZ

Presently, the number of immigrant moving to the Amazon area is decreasing. However, the concentration of population is increasing in the city and the immigrants who conduct exploitative farming and land utilization in the innermost depth of the Amazon region is still under way. Expanding the cultivation of soybeans from Cerrado in the south to Amazon region and the construction of infrastructure caused by developments provides serious impact to environment in Amazon region. Especially Varzea Area known for its fragile ecology received serious impact caused by planting and infrastructure development. The activity of new development in the

Amazon region provide serious impact to this region. Accordingly, EEZ project is being carried out presently as a subprogram of Natural Resources Policy Subprogram (SPRN) under the PPG7 project by PGAI.

(4) Implementation of EEZ

In the Amazon State, EEZ projects conducted by PGAI, GTZ and German Bank of Development (KfW) are providing technical and financial cooperation for EEZ project. Annex 5.3.4-4 shows the organization for implementation of EEZ project. State EEZ Commission (CEZEE) established by Amazon State Governor in 1996, is a representative institution for the State level EEZ project and organized civil society etc. responsible for conducting research and education of EEZ project. At present stage, EEZ project is carried out by PGAI under the PPG7 project. In the PGAI project, 3 main projects are proceeding in which the following results are expected: ⅰ) Result of EEZ, ⅱ) Control and monitoring of environment ⅲ) Decentralization of development activity and database system of environment.

Presently, the priority projects are carried out in the priority areas of Northwest (Vale do Rio Uatuma) and the Southwest (Vale do Rio Madeira) in the Amazon state according to its importance on social-economic development and tendency of forming corridors of economic and demographic growth. In the zoning work, clarification of national park, reserved forest area, indigenous people's land etc. are proceeded, also the zoning covers extractive areas such as hunting, fishing, planting etc. in the Municipality and communities in Amazon region. To reflect the opinions of the local residents, the zoning work is being conducted with the cooperation of local residents who knows well the existing conditions of the extractives. The implementation of zoning requires the development of human resource capabilities, which involves training, equipment, and structuring of database. According to the report issued by IPAAM, the main activity of each phase in the EEZ project is planed as shown in Table 5.3.4-1.

Table 5.3.4-1 Phase and Activity of EEZ Project

Phase	Activities
First Phase : Political orientation of zoning	・Government defines the basic methods for zoning through programs and development plan ・Define policies of EEZ with regard to integration and policy of union for State and Municiparity
Second phase **:** Survey for zoning	・Conducting survey and data collection regarding to phiscal, biotic and economic data.
Third phase 1 **:** Zoning prognostics	・In the survey, carry out disscussion with representatives of involved local residents and collect data and information.
Third phase 2 **:** Zoning prognostics	・Through sufficient discussion with organized civil societies, agreement of land use plan will be obtained. ・Publishing survey result according to a definite scenario of EEZ
Fourth phase **:** Zoning implementation	・Creating legal based action plans for various government organizations. ・Creating legal based zoning legislation, regulation and adaptation of the administrative action, public investiment and licensing of private activities according to the EEZ ・Providing orientation and political support for implementation of EEZ

Data source : IPAAM, 2000

(5) Schedule of PPG7 and EEZ

Participants' meeting of the PPG7 was held in Cuiaba in June 1, 2001. In this meeting, the need for speedier and more efficient implementation of the first phase was agreed and taken into account, and the program is expected to enter its second phase in 2003. The revised strategy shall be prepared after a transition phase by the participants of the program and should run for a period of about four years. There are no final products visible from the Amazon EEZ presently because the work is still on its diagnostics phase. However several survey results executed in this project have been published for IPAAM's internal use. Scheme area by the JICA project was not assigned as a priority areas according to the information obtained from IPAAM. Presently, neither official project schedule nor details of survey plan in the JICA project area is yet fixed. However, survey for Maues region will be implemented from 2003 and the execution of work is expected around one year. Annex 5.3.4-5 shows information of proposed new project for PPG7.

5.3.5 Forest Resource Management

(1) Government Administration

In the Amazonas State, all of administration work for the forest resources are managed and controlled by both organizations of IBAMA and IPAAM. Basically, the deforestation and development of forest more than 2,000 ha required license approved by both of organizations according to law. The applicants who desired development more than 2,000 ha have to submit the preliminary application with required form previously, and have to obtain financial guarantee through the bank. After obtained bank guarantee, applicants have to submit official application in which including forest management plan. After obtained approval of forest management plan and EIA from the IPAAM and IBAMA, Wood Extraction Company starts the work based on application. The conditions of forest, deforestation plan, study environment etc. are required in this application according to law. Application and procedure of forest management plan is shown in Annex 5.3.5-1. IPAAM received 3 official applications in this year. Table 5.3.5-1 and Figure 5.3.5-1 shows data of management plan and wood company. The forest management including ins-pection and monitoring is carried out by 8 engineers and 36 inspector of IPAAM and one engineer and 34 inspectors of IBAMA for the preservation of rain forest.

Table 5.3.5-1 Data of management Plan and Wood Company

States	Area (1000km2)	Nos. of Management Plan	Ratio (%)	Wood Company	Ratio (%)
Para	1,253	740	46	2,418	39
Mato Grosso	907	591	37	3,026	49
Rondonia	239	73	5	549	9
Maranhao	333	66	4	-	-
Amazonas	1,578	61	4	115	2
Acre	153	31	2	60	1
Amapa	143	19	1	-	-
Tocantins	278	11	1	-	-
Total	4,884	1,592	100	6,168	100

Source: IBAMA1997

(2) Forest Management of Local Inhabitants

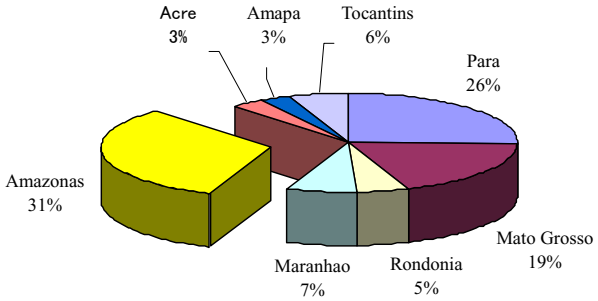


Figure 5.3.5-1 Area of Forest Management Plan

Regarding to the organization and management system in Brazil, it is objected mainly for the woods company in which carried out large-scale industrial deforestation. However there are many local inhabitants, rubber gatherers, indigenous peoples who live in Amazon floodplain. For the methodology to improve social development and preservation of forest, it is required to proceed forest management by local inhabitants. According to these situations and as countermeasures, IBAMA issue decree of No. 4 in 1998, which aim to proceed forest management by local inhabitants. Local inhabitants can become joint control of forest which to be limited 500 ha with conditions to prepare and submit forest management plan to IBAMA and IPAAM. Accordingly, forest management by local inhabitants is become possible presently. Already, there are 5 project experiences approved by IPAAM based on this law. However there are no experiences in the targeted area of Iranduba, Itacoatiara and Maues.

(3) Forest Management by IDAM

Regarding to the forest management for small farmers, none of sections and personnel who assigned in IDAM. At present stage, almost all forest management and administration work for the deforestation in the project is conducted by IBAMA and IPAAM. Only the work requested by farmers regarding to technical matters are supported by IDAM.

5.3.6 Aquatic Resource Management

(1) Current Fishery Resource Condition

Almost all the researchers, fishermen and frozen-processing companies which were interviewed in this study suggested that valuable fishery resources such as pirarucu, tambaqui, surubim and other large-size catfishes have decreased seriously. Size of fishes caught has been getting smaller although regulation on minimum allowable capture size is applied. Since those species have relatively long reproductive cycle, it would take time to achieve rehabilitation of the resources.

However, objective data explaining reduction of fishery resources are scarce presenty. Figure 5.3.6-1 is prepared by integrating available fish unloading information in Manaus, and indicates a decreasing trend of tambaqui unloading.

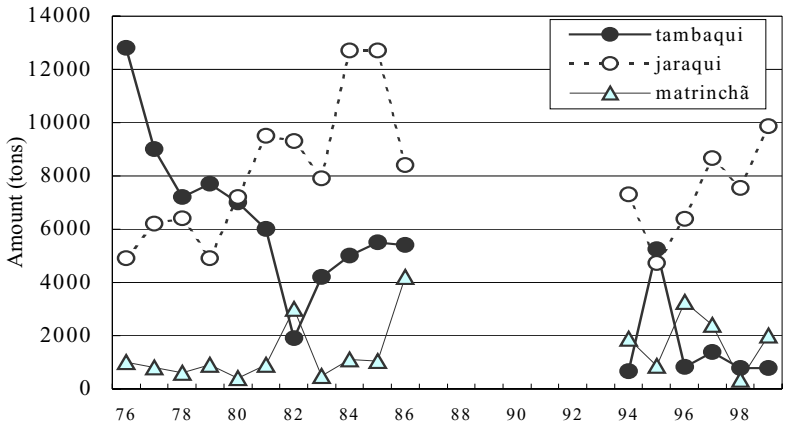


Figure 5.3.6-1 Change of fish unloading amount of tambaqui, jaraqui and matrincha in Manaus

Source:
Merona and Bittencourt (1988): data from 1976-86 for all Manaus
Batista (1998): data from 1994-96 at Panir fish landing place

(2) Laws and Regulations on Fishery Resource Management

The basis of fishery regulation governing the whole country is attributed to the Decree-Law No. 211 declared on 28 February 1967 and Law 7679 on 23 November 1988. As stated in many reports (Isaac et al., 1993; Isaac et al., 1998, Isaac and Ruffino, 1999), these two statutes associated by many other national, state and regional norms and administrative ordinances support a series of conventional regulations, which are often different from State to State. Those are prohibition of fishing during reproductive migrations, limits on mesh size, minimum sizes, and the prohibition of especially noxious gear such as explosives and poisons. The enforcement of those regulations, however, was often not effective, because government agencies have not their sufficient personnel and resources to enforce compliance.

Among many laws and regulations, Portaria No. 8 of 2 February 1996 edited by IBAMA is significant, because it eliminated many other old inconsistent measures pertaining to the fishing in the Amazon Basin. For example, minimum catching size is restricted only for four species as followed based on a series of scientific examinations (Isaac et al., 1998):

Tambaqui, *Colossoma macropomum*	:	55 cm
Pirarucu, *Arapaima gigas*	:	150 cm
Surubim lenha, *Pseudoplatystoma fasciatum*	:	80 cm
Surubim tigre, *Pseudoplatystoma tigrinum*	:	80 cm

Purse seine had been prohibited in the Para State, which was not in the Amazonas State. After the Portaria No. 8, this fishing method could be able to use in both States.

Allowable fishing season for pirarucu and tambaqui is declared almost every year considering their resource conditions. At present, fishing of pirarucu is totally forbidden in the Amazonas State except for some juvenile catch for aquaculture, and that of tambaqui is prohibited for 3 months from December to February.

In Amazonas State, a total of 16 groups of tributaries or river stretches are identified as seasonal sanctuaries (Figure 5.3.6-2). Commercial fishing in those areas is prohibited for 4 months from November to February. However, in reality no body believes that the regulation is kept properly, since there is no inspectors.

(3) Control of Fishing Efforts

In recent years, IBAMA has offered fishermen a compensation program for suspension of fish catch through DRT (Regional Labor Office). For instant, fishermen who agreed with suspension of fishing operation during the certain period that is declared locally by IBAMA would be paid with R$ 151.00 per month. In order to obtain this privilege, fishermen shall fulfil following criteria.

- Fishing is the only livelihood for recipients.
- Recipients shall be a member of Colonia for at least three years.
- Recipients paid the INSS (social security) for at least three months.

In the case of Maues, about 200 fishermen out of 850 Colonia members are recipients of this program during the period from December to February when matrincha, pirarucu and tambaqui are forbidden locally. There are several fishermen benefited by this program in Iranduba and Itacoatiara.

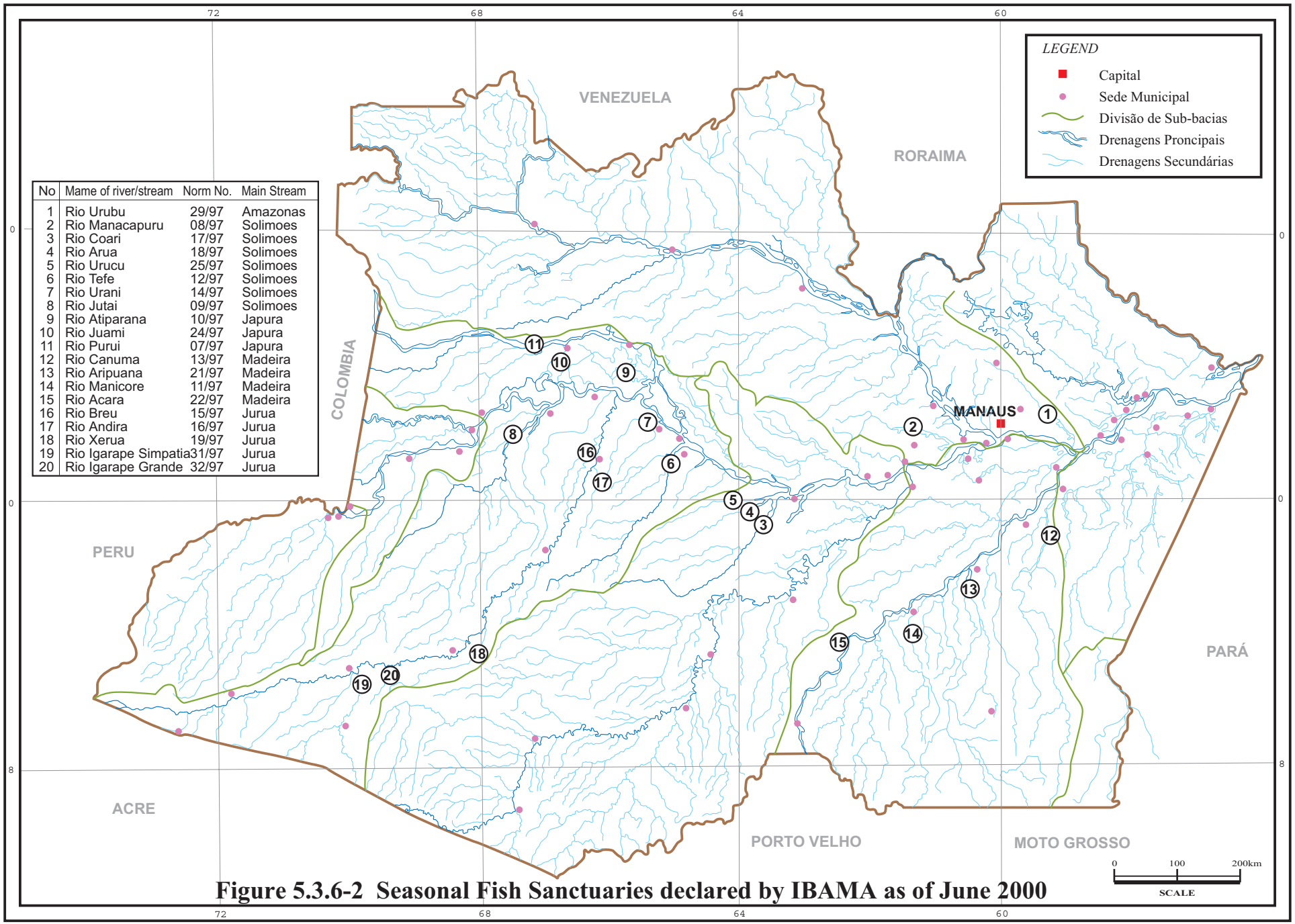
5.4 Rural Society

5.4.1 Municipality of Iranduba

(1) Population

The population of Iranduba was 18,876 in 1991 increasing to 26,612 in 1996. A study carried out by the Joaquim Nabuco Foundation projected that this would increase to 33,516 by 2000 and 36,371 in 2005. The average annual growth rate is calculated at 7.1% for the period 1991-1996 and 5.9% for the period 1996-2000, which were highest in the Amazonas State. Major reasons to this are explained as follows:

- Structuring of the municipal public services, in particular health, housing and transport together with its location near to Manaus attracted rural people to Iranduba.
- People from Manaus city such as victims of floods relocated to Iranduba
- Activity of frozen-processing factories of fishes and increase in the brick-making industry attract people from rural areas seeking work.



No	Mame of river/stream	Norm No.	Main Stream
1	Rio Urubu	29/97	Amazonas
2	Rio Manacapuru	08/97	Solimoes
3	Rio Coari	17/97	Solimoes
4	Rio Arua	18/97	Solimoes
5	Rio Urucu	25/97	Solimoes
6	Rio Tefe	12/97	Solimoes
7	Rio Urani	14/97	Solimoes
8	Rio Jutai	09/97	Solimoes
9	Rio Atiparana	10/97	Japura
10	Rio Juami	24/97	Japura
11	Rio Purui	07/97	Japura
12	Rio Canuma	13/97	Madeira
13	Rio Aripuana	21/97	Madeira
14	Rio Manicore	11/97	Madeira
15	Rio Acara	22/97	Madeira
16	Rio Breu	15/97	Jurua
17	Rio Andira	16/97	Jurua
18	Rio Xerua	19/97	Jurua
19	Rio Igarape Simpatia	31/97	Jurua
20	Rio Igarape Grande	32/97	Jurua

Figure 5.3.6-2 Seasonal Fish Sanctuaries declared by IBAMA as of June 2000

5 - 23

- Reduction of flow-out of young population due to relative decrease of employment opportunity in the electronics sector in Manaus.
- There has been a trend for people from Manaus to try their hand at small scale farming in Iranduba.

(2) Housing Program

There is a housing program for lower income population in an area called “multirao”, where plots are separated and the area receives services such as potable water and energy supply. There are 600 plots at present. The municipality administration supports families with providing construction materials.

A similar program is available in rural communities, and more than 100 wooden houses with two rooms have been constructed.

(3) Health

There is a health center at the Iranduba town called Unidade Mista, which is supported by the State Health Office, offering 17 beds (Table 5.4.1-1) and providing the following services: out-patient clinic, vaccination, dental care, and pharmacy. There are two dentists and 12 doctors allocated. The endemic diseases reistered are malaria, verminosis and tuberculosis. About sixty people are consulted daily.

Table 5.4.1-1 Health Infrastructure

Description	Quantity
1. Type	Unidade Mista
2. Laboratory	1
3. X-Ray	-
4. Surgical centre	1
5. Blood bank	-
6. Beds	17

Source SEPLAN - 1997

In rural area small health centers are located the Cacau Pirera District and such communidad as Cavalcante, Jandira, Limao, Ubim, Paricatuba, Lago do Ariau, Costa do Iranduba, Caldeirao, Acajatuba, Ilha da Paciencia and Baixio. In these communidad a total of 56 municipal agents who were trained by SESAU(State Health Agency) is now working.

In addition to this, there are periodical boat trips to provide health care for communidads. The boat is sponsored by CODEAGRO and there are dentists and nurse on board.

(4) Education

Number of school in Iranduba is summarised in the following table. There are a total of 89 primary schools and 2 middle schools (Table 5.4.1-2). In 1998 the total number of students was calculated at 9,383 with 350 teachers giving a ratio of 26.8 students per teacher.

Table 5.4.1-2 Education Infrastructure

Type of Education	State	Municipal	Private	Total
Infant school	1	45	2	48
Primary School	2	84	3	89
Middle School	2	-	-	2
Special	1	-	-	1
Supplementary	2	14	-	16

Source: SEPLAN/AM – 1997 in ISAE

(5) Industry

Apart from extractive activity, agriculture and fishery, there are two significant secondary industries developed in this municipal. One is brick-making factory, and the other is frozon-processing company (frigorifico) of fishes. About 60 brick-making factories are operating along the main road of the municipal. There are two frigorificos in the Iranduba town namely FRIUBA and DORADO. FRIUBA was known to be the biggest frigorifico in whole Amazonas State, exporting more than 3,000 tons of fishes. However, it has stopped operation this year due partly to recent decrease of fishery resources. There is a resort hotel, Pousada Amazonia having 23 rooms and a meeting room for 120 persons at km 36 of the Manaus-Manacapuru road, beside the Ariau river. In 1997, there were 253 micro businesses such as services and commerce in this municipality.

(6) Transportation

(a) Air service

There is no air services to the municipality. There is no landing field available.

(b) Land carriage

The access to Iranduba municipality is carried out through road. The journey begins at Porto das Balsas where a ferry crosses the Negro River in around twenty minutes, straight to Cacau-Pirera community. There is a bus transportation from Cacau-Pirera to Iranduba town through Manuel Urbano Road (Am 070) and Iranduba road.

(c) Water carriage

River transportation is not a common practice among the population, except when they want to transport their products for trading in the municipality. There is no regular passenger transportation.

The community administration has a boat lent by CODEAGRO to transport medicines and urgent passengers to rural communities.

(7) Water Supply

There is a French private company Lyonnaise des Euxs (former State company COSAMA) which is responsible for tap water supplies. At present 24 hours water supply is achieved in a part of the Iranduba town. There are 1,345 pipe connections: 998 domestic, 14 commercial, 4 industrial, 18 State agencies and 311 unavailable (not paid bills).

(8) Power Supply

Power is provided from a diesel power plant Manaus Energia LTDA. Three generators with a total of 4, 997 KWA of capacity are operated for providing

electricity 1,832 consumers presently. However, current capacity of power does not correspond to increasing demand from local people and industry.

(9) Sanitation

The municipal administration is responsible for the sanitation, which include services like lawn mowing, trees crowns pruning, street and public institution sweeping, drain sewer cleaning, etc.

The waste collection takes place during the week, except weekends and holidays. There are trucks, wheel barrels and garbage collectors to this service. The waste is deposited in appropriated surrounding areas.

5.4.2 Municipality of Itacoatiara

(1) Population

The population of Itacoatiara was 52,888 in 1980 increasing to 58,757 in 1991 and 64,937 in 1996. It was projected to reach 68,972 in 2000 and 74,848 by 2005 (Fundacao Joaquim Nabuco). The growth rate was 2.02 % from 1991-1996 and projected to be 1.52 % for the period 1996-2000. In 1980 it accounted for 3.70 % of the state's population, which reduced to 2.72 % in 1996 (Fundacao Joaquim Nabuco). In 1996 the urban population accounted for about 66% of the total. Growth has been in the urban areas as there has been marked migration from the rural to urban areas, for example with the financial collapse of the Jute industry. It is observed that there is a tendency of families to re-locate to the urban areas (Manaus or Itacoatiara) and remain there.

(2) GDP

The gross domestic product (GDP) has rising in recent years from R$ 216,433 in 1991 (R$ 3,683 per capita) to R$ 426,128 in 1997 (R$ 6,495). This is an economic increase. According to the data of SEPLAN/AM, the ratio of industrial products for the timber and wood comprised 51.16% of the whole products in Itacoatiara, which having large share and 46.45 % in service and 2.38 % in the primary sectors.

(3) Cattle Breeding

The municipality has a large quantity of livestock. Bovine is the main breed. In general, pastures are in good conditions. Cattle breeding are the most important activity in the municipality not only the consumer market but also the people's diet. Another factor assisting beef production and cattle raising, as well as, transportation facilities are roads that link the municipality directly with the Capital of Manaus. According to IDAM's information, there are 436 cattle breeders in the municipality.

(4) Industry

The industrial production in the municipality relies on timber industry, furniture

industry, food industry and metallurgy. The most important is timber industry, which is developing projects of managed timber exploitation. Managed timber exploitation is necessary to obtain sustainable timber production. The wood extracting companies generate jobs to the local residents and increase the tax collection.

(5) Employment

According to the Labor Ministry, 2,760 workers are currently employed under the CLT laws. They are distributed as 341 in commerce, 1,833 on the industry, 505 in service and 77 in agriculture including cattle breeding. During January 1997 to July 1999, 2,975 employees were hired and 3,236 were fired. It is observed that industry was the field that had the highest number of layoff. In the municipality, 71 % of the population earns less than two times the minimum monthly wage, and 20.88 % earn two to five times, 5.33 % earn from five to 10 times, and 2.1 % earn more than 10 times.

(6) Health

There is a hospital in the municipality, the Unidade Mista, which is supported by State Health Office. It has Approximately 130 beds, and offers health services such as: first-aids, outpatient clinic, and small and medium surgical procedures. According to reports from ICOTI (Institute for Inter municipalities Technical Cooperation) there are seventy health centers spread around the rural zone. Table 5.4.2-1 shows health infrastructures.

Table 5.4.2-1 Health Infrastructures

Description	Quantity
Type	Medium size (Hospital de Medio Porte)
Laboratory	1
X Ray	1
Surgical Centre	1
Blood Bank	1
Number of beds	122

Source: SEPLAN/AM - 1997

(7) Education

The educational system of Itacoatiara consists of the municipal schools, state schools and the private school. It also has an extension of the Amazon State University. Overall, there are 145 schools, 23 of these are located in the urban area and 122 are located in the rural area. The number of enrolled student is 35,259. Out of these, 19,211students studies in urban schools and 6,038 study in rural schools.

Table 5.4.2-2 Education Infrastructure

Type of Education	State	Municipal	Private
Infant school	10	14	4
Primary	14	198	2
Middle	2	-	1
Special	3	-	1
Supplementary	6	4	-
Total	35	216	8

Source: SEPLAN/AM – 1997

Literacy rate: 58.51% (1991 in PMDR 1997-2000)

Literacy rate urban: 70.32%

Literacy rate rural: 29.68%

School drop-out rate:

Primary school (urban): 21%

Secondary School (rural): 24%

(8) Transportation

(a) Air Service

There are no regular airlines to the municipality. There is a small landing field with 1,500m of extension. There is a taxi plane service. The landing field is 9 km far from the center of city, through state road AM-010.

(b) Water Carriage

Water carriage across the Amazon River, links Itacoatiara to others municipalities. Regional boats are usual. These boats usually are able to carry with 150 to 200 passengers. There is a harbor to embark and disembark people and cargo.

(c) Land Carriage

There are 10 vicinal roads linking the seat of the municipality to nearby communities. This provides flow of products from the communities to the municipality. There is one, AM-010 Road. It links the municipality to the capital of the State, Manaus. It has 286 Km of extension. Sometimes this road is endures bad traffic conditions. There are two lines providing bus service to the municipality. There is one terminal station in the municipality in which selling bus tickets.

5.4.3 Municipality of Maués

(1) Population

The population was 30,014 in 1980, 30,499 in 1991, 36,628 in 1996 and projected to be 41,412 and 44,940 for 2000 and 2005 respectively (Fundacao Joaquim Nabuco) The growth rate was 3.73 % between 1991-96 and projected to be 3.12 % for 1996-2000. There has been a negative growth rate in the rural areas (ICOTI, Maués 1996). There has been an increasing urbanization of the population, going from 36.01% in 1980 to 54.62 in 1991 and 51.35% in 1996. The population represented the following percent of total state population:

1980	2.10 %
1991	1.45 %
1996	1.53 %

Projected to be 1.59 % in 2000 Further from Manaus than either Iranduba or Itacoatiara, the overall density was 0.91 personnel/km2. However, different from the official data above, the Municipal authorities calculate that the total population is around 60,000 (PMDR 1996) with the population being roughly divided between the urban and rural areas. Differences in data such as this illustrate the difficulties involved in obtaining reliable statistics, particularly for the rural areas of the state.

(2) Agriculture

The primary sector of this municipality is based in agriculture, cattle breeding and

vegetable extractive (timber, oil and rubber), mineral (gold, mineral coal, calcareous (chalky) and animals (hunting and fishing). Guaraná is the most important crop in this municipality, which are exported to another states and also to foreign countries such as Germany, United States and Japan.

(3) Industry

There are small industries in which use family labor in the guaraná processing such as sticks, powdered, and syrup form. These small guaraná based enterprises sell part of their products to other cities as Manaus, Roraima, São Paulo, Mato Grosso, etc. There are also existing small industries like saw-mill, cabinet makers, dockyards, handicraft and foods and açaí processing factories. Table 5.4.3-1 shows number of establishments.

Table 5.4.3-1 Number of Establishments

Items	NO. of Establishment
Commerce	113
Services	17
Total	130

Source: RRA and Questionnaire Survey by Study Team (2000)

(4) Employment

According to the Labor Ministry, 2,530 workers are currently employed in the municipality. Total of 1,516 are employed by the municipality administration, 520 are employees of state and federal organizations and banks and other services. Only 494 personnel are employed by industry and commerce which giving a percentage of 19.6 % of all formal jobs.

(5) Health

The municipal health department has 114 employees, with a further 108 state health employees and 7 FUNASA employees. There are no health clinics in the rural areas whatsoever. In the rural areas, community health agents work under the municipality. There is a hospital offering 54 beds and 3 Health Centers in the urban zone and there are 40 Health Centers in the rural zone. Table 5.4.3-2 shows health Infrastructures. FNS (National Foundation for Health) has a bureau in the municipality and runs vaccination programs, malaria control and prevention and medical support for indigenous people. There is a NGO–Amerindia Corporation providing medical assistance and epidemic control in indigenous areas.

Table 5.4.3-2 Health Infrastructures

Description	Quantity
Type	Medium size hospital
Laboratory	1
X Ray	1
Sugical centre	1
Blood bank	-
Number of beds	54

Source: SEPLAN/AM - 1997

The rural areas are attended through 95 health posts, with Community Health Agents (Programa Nacional de Agente Comunitarios de Saúde).

(6) Education

The educational system of Maués consist of the municipal schools, state schools and the private school. Overall, there are 158 schools, 12 of these are located in the urban

area and 147 are located in the rural area. The number of enrolled student is 8,718. Out of these, 4,459 students study in urban schools and 4,259 study in rural schools including indigenous area. Table 5.4.3-3 shows educational infrastructures.

Table 5.4.3-3 Education Infrastructure

Type of Education	State	Municipal	Private
Infant school	8	27	1
Primary	8	131	1
Middle	1	-	-
Special	-	-	1
Supplementary	2	-	-
Total	19	158	3

Source: SEPLAN/AM – 1997

(7) Transportation

There are only two ways to get to the municipality, by boat or by plane. There is regular airline available only one flight in a day. Water carriage is the most common way to access the municipality. Almost all roads located in the remote area are unpaved road and without maintenance.

5.5 Agriculture and Fishery Production, Processing and Distribution

5.5.1 Guaraná

This section will focus on existing conditions for the production, processing, distribution and marketing problems of guaraná for the farmers of Maués. After a brief introduction which explains the characteristics of the plant itself and its regional importance in Brazil, a more detailed discussion of the existing production and post harvest condition of Maués farmers will follow. Most of the information was obtained through personal and group interviews of guaraná producers in the three communities of Bom Jesus de Pupunhal, Ponta Alegre, and Nossa Senhora de Nazare.

(1) Introduction

(a) Plant description, occurrence, and production cycle

The guaraná tree found most commonly in the Brazilian Amazon region is scientifically known as Paullinia cupana var. sorbilis (Martius) Duke. It is native to the Amazon and is distributed in a region defined by the Amazonas, Maués, Parana do Ramos, and Negro rivers, the State of Amazonas, and the Orinoco River basin of Venezuela. The plant is an upright, semi-erect bush with large green leaves whose natural growth habit is among other forest tree species. It can reach a height of 9-10 meters. It produces fruit in bunches which are similar to fruits produced on the branches of coffee trees. Each fruit has 1-3 compartments each with one seed per compartment. At maturity, the external fruit turns into a dark yellow-red color and the seed becomes surrounded by a white fleshy layer. The seed is round, shiny black and is the only part of the plant, which is harvested for commercial use after a process of cleaning and roasting.

Guaraná has many proven medicinal benefits, such as sedative properties, regulation of cardiovascular function, regulation of intestinal function, prevention of arteriosclerosis, high caffeine content (three times greater than that of coffee), general stimulation of diverse physiological functions, and aphrodisiacal properties.

Under Maués conditions, guaraná trees are produced from transplanted seedlings. The seedlings have two possible origins - from true seed or from a vegetatively produced clone. Seeds can be selected from guaraná trees growing wild in the forest, from a neighbor, or from mother plants in an established nursery. Cloned seedlings are only available from nurseries managed by EMBRAPA (Brazilian Enterprise for Agricultural Research) or AmBev (the leading company which manufactures guaraná soft drinks). Planting normally occurs in February/March during the wet season, followed by flowering in July/August during the dry season. Fruit production is prevalent in August/ September with ripe fruit normally harvested during the months of October/ November/ December. Production is minimal in the first year. Plants from seeds reach full production potential in 4 years whereas those from improved clones are fully productive in 3 years. With the proper agronomic management, guaraná trees can remain fully productive for 15 - 20 years, however, most plantations in Maués lose their productivity after only 8-10 years.

(b) Principal production areas

Brazil is practically the only producer of guaraná in the world. Some production occurs in the Venezuelan Amazon. Guaraná was first cultivated and utilized by the Maués Indians of Amazonas, who gave the plant the name it bears today. Amazonas has enjoyed a virtual monopoly on guaraná production but in the mid-1990's it lost its relative advantage as production spread to Bahia, Mato Grosso, São Paulo, and even Rio de Janeiro (Table 5.5.1-1).

Table 5.5..1-1 Guaraná Production (tons) in Maués Municipality, 1997-1999

	1997	1998	1999
Amazonas State	630	632	530
Maués	270	276	280
Maués (% of State)	43	44	53

Source: IDAM Municipal Production Data, 1999

In the early 1900's, the largest producer of guaraná was the State of Amazonas and 90% of this production was centered in the municipality of Maués. Currently, Maués is still the most important municipality for guaraná production, but its percentage contribution has dropped to 40-50% of the State total:

In the period after 1980 and up until 1998, due to a variety of problems that will discussed in the section on "Problem Analysis", Maués production declined and the State of Bahia became the largest producer in Brazil (Table 5.5.1-2). Amazonas State was second in importance, but even the State of Mato Grosso has developed the potential to supercede Amazonas in the near future if the yields in Maués cannot be improved:

Table 5.5.1-2 Guaraná Production as a Percentage of National Production, 1994-1998

	1994	1995	1996	1997	1998
BRAZIL (tons)	2,674	2,390	2,270	1,995	2,938
Roraima (%)	25	6	0	0	0
Acre	1	1	1	2	1
AMAZONAS	13	21	22	18	26
Para	1	1	2	0	1
Bahia	53	65	67	73	62
Mato Grosso	7	6	8	7	10

Source: IBGE Yearly Statistics, 1999

(2) Production

(a) Soil and climate

Guaraná grows well in tropical environments that are hot (range of 20 - 40ºC), humid (>80%), with an average rainfall of > 1,400 mm/yr. However, the Maués environment is particularly adverse. Ideally, rainfall should be as uniform as possible, however, in Maués, often during the months of June - September, one or more months can yield less than 100 mm of rainfall, resulting in drought stress on the plants. Humidity in Maués can also be > 90% for long periods of time, without any significant ventilation from winds. These stagnant, suffocating conditions create an optimum growth environment for several devastating fungal diseases of guaraná, which thrive in Maués. Maués is predominantly covered in the deep, heavily textured yellow latosols of the Amazon Basin. These soils are poor in nutrients (due to their shallow topsoil layers which are low in ph and high in aluminum) but are well drained. With proper fertilizer amendments, guaraná can have high yields, as long as the planting areas do not become flooded. Guaraná gives very poor yields in overly wet soils.

(b) Seedling production

The vast majority of farmers in the three communities raise their seedlings from seeds of highly productive plants gathered in the forest, on their own farm, or from a neighbor's farm. Some obtain seeds from the research farms of EMBRAPA and AmBev in Manaus but most choose to make selections near their own properties, believing that those seeds will give the highest yields for their local conditions. These seeds are then germinated in a special protected area and then transplanted to the field location at a later date. Other farmers choose to harvest small cuttings ("estacas") from the best locally available trees and then plant them after they have been rooted in a protective environment.

Seedlings of "improved clones" which have been produced by EMBRAPA (such as "BRS-Amazonas") or by EMBRAPA in collaboration with AmBev ("BRS-Maués") are also available for use by the farmers. These cloned seedlings, when properly managed, have a significant yield advantage over materials selected by the farmers since they are resistant or tolerant to one or more of the local disease and pest

problems (anthracnose, fusarium, thrips). They also are preferred by the processors since they have higher caffeine content than traditional seedlings.

The farmers cannot afford these clones as they have a commercial value set by EMBRAPA at 2.0 - 2.5 R$ /piece, and 300 - 400 are needed for a one hectare field. The clones must either be donated or purchased upon receipt of credit. As a result, only one of the 3 communities (Nazare) had a significant planting (4 ha) of these clones. Farmers in all three locales had heard of the clones, and every community had a few farmers who had been trained in the use of these clones (usually through a field day at the EMBRAPA farm in Maués), but adoption rate was very poor. After all, the traditional low yielding seedlings from the forest are free of charge. Seedlings from seeds are sold at 1.5 R$/piece.

Table 5.5.1-3 Current and Planned Distribution of EMBRAPA Guaraná Clones

(seedlings)

Recipient	2000	2001 (Est.)
Small farmers (Maués)	27,000	125,000
AmBev group (Maués)	20,000	20,000
Coca Cola (Jayoro Farm)	2,000	80,000

Source: EMBRAPA-Maués, 2000

(c) Land preparation

A striking feature of the farming situation in Maués is that in all three targets communities there is an abundance of land for planting. Most guaraná farm families have access to over 20 ha of land:

Table 5.5..1-4 Average Farm Holding Size (ha), and Average Area

( ) Planted in Maués Communities)

	Bom Jesus	Ns. Nazare	P. Alegre
Average	30 (5.3)	24 (2.8)	52 (5.8)
Minimum	0.5 (0.5)	4 (1.0)	15 (0)
Maximum	100 (20)	50 (6)	150 (28)

Source: RRAQS, 2000

Although the farmers have access to holdings that are 30 - 50 ha in size, most only have 5-8 ha in guaraná production (3 - 4 ha productive, 3-4 recently planted). Importantly, the Maués farmers have a choice as to the type of planting area for their guaraná. They can either clear virgin forest area for planting, or they can plant the seedlings in degraded secondary forest (capoeira) which usually has a prior history of crops such as cassava and banana. In the virgin forest, slash and burn technique is used leaving large stumps and felled trees.

In all three communities, there is a clear preference to slash and burn the virgin forest instead of selective clearing of the capoeira. Farmers feel that the crop yield is better from virgin land, and they feel strongly that long term weed control is much easier in recently cleared virgin forest. This is why they are willing to initially spend 30 man/days/ha preparing a field from forest, vs. 15 man/days per ha preparing a capoeira site. EMBRAPA research has shown that yields from properly managed capoeira land can be just as high or higher from those of cut forestland. Farmers are either not receiving this information or are not accepting the information.

(d) Planting

Seedlings are transplanted into the field from the nursery when they have 2 or larger

composite leaves. If available, the farmer applies a combination of animal dung and super triple phosphate as fertilizer. Most should also apply lime to correct the highly acid soils but this is rarely done. The few who have access to fertilizer often have received very little training and much mismanagement occurs. Some refuse to apply fertilizer at planting, preferring to save it for application at a later time when they have a better idea about the market price.

The transplant is covered by a canopy of banana leaves to provide shade for the first 6 months. Most farmers try to plant on a 5 x 5-meter spacing in order to obtain 400 plants/ha, but usually due to stumps and other debris, 300-350 plants/ha is the actual planting density. Farmers rarely attempt to plant guaraná with a mixture of other crops - they do not yet see the potential benefits of "consorcio" farming.

(e) Cultural practices

Weeding

Guaraná fields require a substantial investment of labor in order to keep them free of weeds. Normally, the fields should be weeded manually three times per year - once before flowering and twice before harvest. Weeding should occur around the base of the plant ("coroamento") in a circle of about 2 meters in radius, and also between the rows of the plants ("rocagem") in order to prevent weeds from eventually taking over the field. Farmers in all three communities complained of the time and expense required for these weeding operations, especially given the low price at harvest. Each weeding operation can take up to 20 - 30 man-days of labor per hectare. This is beyond the capacity of family labor if the holding is greater than 2 ha, and normally this work is too demanding for women and children. The alternative is to hire labor at an average cost of 6 R$/day (plus meals). But very few of the farmers can afford such an expense. The shared, community labor method ("multirao") is practiced by all three communities at harvest time, but not for weeding. Normally, the weeding activity is so labor intensive that farmer falls behind in the other chores which generate food and income (cassava production, fishing), and at some point he simply has to abandon the fields and find food for his family to eat. Often he finds temporary work in the Brazil nut plantations near Maués in order to generate cash for food and supplies.

The reality in Maués is that most farmers are not currently weeding their fields at all - perhaps 30% are able to weed their fields once or twice at most. The result is that the guaraná fields are in a serious state of decline. The farmers admit this, but say that it is not worth the time and effort to keep the fields clean at the current price of 4.6 R$/kg.

Pruning

EMBRAPA research clearly shows that guaraná fields should be pruned twice during

the annual crop cycle - once after harvest (to remove any dead, diseased, dying branches), and once before flowering (to thin the tree out through removal of 10-20% of healthy buds in order to stimulate the remaining flowers to be more highly and uniformly productive). About half of the farmers in Maués practice a certain degree of post- harvest pruning, investing in about 10 man-days of labor per hectare. Very few believe in, or have the time to trim the trees before flowering. They believe it is a waste of time and also reduces yields.

Disease/Pest control

There are three major pests of guaraná in Maués. The most important is the fungal disease called "anthracnose" (*Colletotrichum guaranicola*). This disease severely attacks the leaves and can only be controlled by the use of resistant varieties and pruning. "Superbrotamento" is another fungal disease (*Fusarium decemcellulare*) which causes the flowering portions of the plant to swell into a dense, unproductive mass. It is also controlled by varietal resistance and pruning. The major insect pest in Maués is called "thrips" (*Liothrips adisi*). Thrips interfere with the formation of flowers, and also can cause the leaves to dry up. Thrips can be controlled only by certain insecticides, which are expensive and dangerous for the farmers to use without proper supervision.

All three of these problems can be found in most any guaraná field in Maués, although in those fields that are using the improved EMBRAPA clones, the incidence is far less. Farmers are generally aware of these pest problems through extension and training, but do not have the time or money to treat the problem. The easiest solution would be the use of the new clones in association with at least one pruning operation.

(f) Harvest

The major difficulty with the guaraná harvest in Maués is that the fruits ripen in a very uneven fashion. As much as possible, fruits of the same degree of ripeness should be harvested and processed together. Maués farmers have a great deal of skill in collecting fruits of the same degree of maturity. This requires considerable patience and experience but results in a much higher quality than fruit harvested in other areas and States.

In order to maintain uniformity, fruits must be harvested two, sometimes three times per week - revisiting the same trees and branches over and over again. This is time-consuming work but in all three communities, all other work stops when the guaraná fruits are ready for picking. Unlike weeding and pruning activities, every one finds the time to harvest the guaraná when it is ready - it is well known that delaying the harvest will result in overripe fruit on the branch or fruit that easily rots if it reaches the ground. For that reason, all three communities utilize a communal labor pool

("multirao") at harvest.

The labor intensive harvest period involves the entire family, a consequence of which is that farinha processing activities cease. Availability of farinha becomes scarce, and therefore the price goes up. Farinha which normally sells for 13-15 R$/sack rises to 18-20 R$/sack during the guaraná harvest.

(g) On-farm processing

Pulp Removal

After picking, the fruits are stored in jute sacks for 3-5 days allowing fermentation to occur. Next there is pulp removal and washing of the seeds - these operations are done manually and usually dominated by women and children. Women perform the all-important task of quality control - deciding which of the harvested fruits are to be discarded or further processed.

Drying/Roasting

Washed seed can be dried either pan roasting, sun-drying, or mechanical drying. All three of the target communities use pan roasters heated over a wood fire. Pan roasted seed is highly preferred by the processing companies and is quite a common farm level practices in throughout Amazonas. A large, shallow pan is used (metal or clay) above a brick oven fire - roasting time is between 3-5 hours and should stop when the moisture level of the seed goes down to 5%. Properly dried seed can be stored for up to one year under Maués conditions, but up to three years with more sophisticated storage. Most households have their own pan roasters, which are also used in the processing of farinha - but the community of Bom Jesus was unique in that it had a village level roasting station which all members of the community are allowed to use.

Members of the Nazare community expressed a particular interest in pursuing drying/roasting techniques utilized by the Satere Indian communities. Those communities use a very slow technique using clay ovens (instead of brick) wherein the seeds are both roasted and smoked. This produces a highly desirable final product, which is marketable at a much higher price. Nazare farmers insist that the Indian communities have a contract with some Japanese buyers and routinely receive 8 R$/kg, almost twice the normal price. They would like to consider employing the Indian techniques and linking to higher priced markets.

(3) Processing

(a) Commercialization

Guaraná is sold in the commercial market in four basic forms:

Bars

After roasting, the shell is removed through a process of pounding, grinding, and

milling. The milled product is then mixed with water to form a uniform paste, which is then manually molded into the form of rounded bars. The moist bars are then smoked under a low heat for a number of days until they are finally cured. The bars are sold to the consumer who generally will use a file or the dried tongue of native fish (pirarucu) to scrape the bar to produce a fine powder fit for consumption.

Grain

The most common way in which the farmers sell the guaraná seed is as roasted grain (also called seeds).

Powder

Powder is formed by milling the roasted grain. It is rarely consumed by the local farmers and is generally sold in Manaus markets. Powder is sold in plastic sachets (100-500g) or in pharmacy-type plastic bottles (in bulk or in capsules).

Concentrate

After the roasted seeds have been wet-milled, chemical extraction of the guaraná paste can take place in order to produce a guaraná concentrate or "pure essence of guaraná". Most soft drink companies have proprietary methodologies for the extraction process, but generally, common solvents such as chloroform or ammonia hydroxide are mixed with the guaraná paste (must be well homogenized) and eventually distilled to produce a dark, bitter concentrate with a caffeine level of 3 - 4%.

(b) Uses

The active ingredients in guaraná seeds are caffeine (4.3%), guaranátic acid (5.9%), and piroguaraná acid (2.7%). These compounds are responsible for guaraná's regulatory effects on the central nervous system, smooth muscle fibers, digestive system, and kidneys. When used regularly, guaraná serves to reduce physical and mental fatigue. By Brazilian law, any soft drinks labeled as "guaraná" must contain in 100 ml of drink, the amount of caffeine found in 0.02 - 0.2 grams of whole seed. In the case of extracts (concentrates), 100 ml of the liquid must contain the caffeine equivalent of 0.1- 1.0 grams of seed.

(c) Guaraná processing activities in the communities

Value-added processing activities in the three communities studied were almost non-existent. Both Nazare and P. Alegre had one or two households, which produced small quantities of bars to a limited customer base in Maués. None of the communities had an established infrastructure to process bars or powder. All three communities agreed that bars are fairly easy to produce, have a good market, and can store well even under village conditions (if properly cured). Powder was said to be more difficult to sell and to produce, and there was little interest.

Despite the favorable outlook for bar processing at village level, the farmers have been reluctant to develop such small industries because they feel it is not in their tradition. They are hesitant to become businessmen and they feel the proper place for production and sale of bars is in Maués town. Also, they cited the lack of capital and technical assistance. Since most agreed that 10 gram bars produced in the villages could sell for 10-12 R$ in Maués, there is a tremendous potential for income generation. What mainly appears to be lacking are well-organized farmer's associations willing to motivate the villagers to become interested in small business opportunities.

(d) Guaraná processing in the town of Maués

Maués has approximately 15 - 20 establishments which produce processed guaraná products, principally bars, powder, and syrup. By far, the most popular product is the bastao or bar. Approximately 100 tons of bars are produced by small companies in Maués (Table 5.5.1-5):

Table 5.5.1-5 Production of Guaraná Bars by Small-Medium Scale Enterprises in Maués (2000)

Processor	Bar Production (tons)
R.P. Dias Guaraná	21
J. Viana Barbosa	30
Otavio H. D. Magnani	20
Industria e Comercio de Guaraná	19
Waldo M. C. Monteiro	7
TOTAL	97

Source: IDAM-Maués

In most of the cases mentioned above, the owners are guaraná traders as well as processors. Several still manage small guaraná farms, which supply some of their raw material needs. These firms work very independently and their market connections to Mato Grosso (where over 80% of the bars are sold) remain closely guarded secrets. In effect, many of the marketing channels to Mato Grosso are, indeed, "closed" in the sense that newcomers to the market find it very difficult to penetrate the market (despite a high demand for product in Mato Grosso). In essence, out of respect for their existing customers, brokers who have established connections to Mato Grosso will not easily take on new suppliers. Also, since most of the trade to Mato Grosso and Manaus is clandestine (in order to avoid government taxes), it is very difficult to get an idea of existing market volume from the trading community.

One of the small processors was willing to describe his company and furnished the information that is described below. According to IDAM-Maués, this company is very typical of the handful of successful small processors of guaraná bars in Maués:

Profile of a small guaraná processor (Guaraná Longe Vida, Maués)

GLV is a small, family run company that for the past 16 years has produced guaraná bars ("bastoes") in Maués municipality. In addition to family labor, they employ 5-10 local laborers and can generally produce over 200 kg of bars in a 6 hour workday. The essential infrastructure they have consists of a receiving area, hammer mill, wet

mill, extruder, bar forming apparatus, and a curing room. The small factory produces about 30 tons of bars per year, or approximately 300,000 bars total or an average of 822 bars/day. Over 90% of their sales are to middlemen who have buyers in Mato Grosso do Sul. GLV is generally paid no more than 10 $R for their highest quality bars. Supply of guaraná seed is generally not a problem for them, although there are some yearly price fluctuations. They are upset that large processors such as Antarctica always get the highest quality guaraná at the lowest price due to their volume buying techniques. GLV wishes to expand its customer base and has used the Internet successfully to acquire some new clients in Europe. The major constraints to GLV's continued success are:

i) Need for new markets
ii) Heavy dependence upon middlemen, and sales focused only in one region (Mato Grosso)
iii) Need for product diversification (such as guaraná powder)
iv) Price fluctuation of raw material, and inability to get lowest available prices due to their low volume

Profile of a largescale guaraná processor (Antarctica Beverages Co. - Manaus/Maués)

Antarctica is one of the largest providers of soft drinks and beer in the country. They were established in 1921 and built a plant in Manaus in 1961. They were the first guaraná soft drink Company to source guaraná from Amazonas, and the first to establish a corporate guaraná farm in the region. The farm, known as Santa Helena, was established in 1972. Currently the farm has a total of 1079 ha, but only 450 are planted to guaraná. In previous years, the farm has provided Antarctica with up to 100 tons of guaraná seed per year. More recently, the yields on the farm have become quite reduced due to infection with anthracnose and the old age of the trees. Currently, the farm has become more important as a research center and as a nursery for new improved seedling clones developed in cooperation with EMBRAPA.

In addition to the research farm, Antarctica has a factory in Maués which employs about 50 people. At the factory, the seeds are first milled and ground as preparation for the extraction process. Antarctica extracts guaraná "essence" from the seeds. This is concentrated into a syrup which is then used to make the guaraná soft drink - a drink which comprises an estimated 30% of the entire soft drink market in Brazil (56% is from cola products). The guaraná soft drink market is outlined in Table 5.5.1-6.

Table 5.5.1-6 Market Share of Major Guaraná Soft Drink Producers

Brand Name	% Market Share	Processor
Antarctica	20	AmBev
Real	20	Santa Claudia
Tuchaua, Tai	15	Coca-Cola
Magistral	7	JCruz & Co.

Source: Antarctica Co. ,2000

In August 1999, Antarctica merged with its largest local competitor in the beverage industry, Brahma, with the support of PepsiCo, a multinational rival. The newly formed company was named AmBev ("A Companhia de Bebidas das Americas"). The AmBev merger still has not been fully approved by the courts, but if it is accepted the new company will become the largest producer of guaraná soft drink in the world, and the third largest producer of beer in the world (combined assets of US$ 4.65 billion).

AmBev has entered into informal technical agreements of cooperation with IDAM and EMBRAPA to expand guaraná production in the region with the promotion of improved (EMBRAPA) varieties and a technology package. After the merger, the objective of AmBev is to source about 450 tons of guaraná from the Maués region alone in 2001, and then 600 tons/year by 2004. AmBev is counting on increased production of guaraná in Amazonas during 2001 - 2004 in order to support it's plan for increased export sales of the concentrate. Guaraná Antarctica, accompanied by the slogan "the flavor of Brazil for the world", will be introduced to over 100 new countries using the international marketing arm of PepsiCo. The concentrate produced in Amazonas will be exported and converted into soft drink in each of the target countries. Currently, 5% of the concentrate is exported - this share is expected to rise to 15% by 2004. AmBev hopes the PepsiCo connection will allow it to capture a 1% share of the worldwide soft drinks market by 2005 (worth US$ 70 billion/yr). The major constraints facing this firm are:

(i) Productivity of local farmers

If the farmers in Maués do not adopt improved farming technologies and increase their yields, Ambev may have to focus its raw material supply activities in other areas such as Bahia and Mato Grosso, where yields are higher and prices are lower (but caffeine content is poorer).

(ii) Foreign market potential

Powder sales appear to be gaining strength in foreign markets, but the full potential of soft drink sales outside of Brazil is still unproven at this point. Thus it is very difficult for AmBev to strategically plan for guaraná sales to export markets over the next 5 years.

(e) Processing possibilities for Maués

There are three market possibilities for the stimulation of the guaraná processing industry in Maués: bars, powder, and syrups/extracts for "ready to consume" energy drinks. Each of these products requires an increasing level of sophistication. Since bars are already being produced and processing has proven to be profitable, and since the production of hygienically sound energy drinks may be too difficult under current Maués conditions, it is prudent to focus upon the economic potential of

the guaraná powder market.

Economic experts at SEBRAE, the Brazilian Support Service for Micro and Small Business, have recently developed an economic viability model for a medium-size guaraná powder production facility. It is timely for potential investors in Maués to consider such a business model since a rival municipality, Urucara, has recently established a powder production facility which appears to be successful.

The SEBRAE model assumes an annual output of 10 tons of product distributed as follows:

- 107,000 sachets of powder with a value of US$ 2.00 per unit
- 57,000 plastic containers with 100 guaraná capsules/container @ US$ 3.70/unit
- 7,000 plastic containers with 50 gr. loose powder/container @ US$ 2.00/container
- 50% reduction of income taxes if factory conforms to Law #756 of Legal Amazonia and to SUDAM standards
- Raw material costs of approximately 8.0 R$/kg for the guaraná seeds
- 5% contingency

Table 5.5.1-7 Economic Viability Analysis for Medium-Size Guaraná Powder Processing Business

Items	Results (US$)
a) Total Investment (equipment, revolving capital)	136,500.00
b) Total Sales Income (sale of powder products)	438,900.00
c) Variable Costs (raw materials, labor, etc.)	280,968.40
d) Fixed Costs (indirect labor + other fixed costs)	38,734.20
e) Total Costs (c + d)	319,702.60
f) Profit (b-e)	88,504.07
g) Breakeven Point (= d/1-c/b)	107,596.00
h) Profit Margin (f/b)	20.16%
i) Profitability (f/a)	64.84%
i) Period of Return	1.6 years

Source: SEBRAE, 1998

Although the above results are hypothetical and have yet to be fully field tested, they offer an initial indication that processing of guaraná powder under Maués conditions might be highly justifiable and profitable within a relatively short payback period (1.6 years). However, the initial investment is sizable by Maués standards and a stable market would have to be identified and satisfied. In the case of a powder manufacturing firm in Urucara, the plant is known to have a contract with buyers in Italy. Highly presentable products are manufactured with Italian labeling and packaging materials preapproved by the customer. The packaging is highly promotional of the "Amazonian" origin of the products.

5.5.2 Vegetables

(1) Production

(a) Production of Vegetables in the State of Amazonas

The State of Amazonas has a total area of 1.558.987 sq km and 5.458 sq km is covered by water. Arable land in Amazonas can be divided into two basic agro-

ecological zones, "varzea" (flood plain areas) and "terra firme" (upland areas). Varzea lands are those lands, which become exposed when the water level of the rivers drops, normally during the months of July through November. This exposure allows them to be used for agriculture during that time. The terra firme lands are upland and are never affected by the rise and fall of the river:

Table 5.5.2-1 Farming Zones of Amazonas, 1999

Terra-firme (firm land)	1.417.237 km2
Varzea(flooded/inundated area, holm land)	141.750 km2

Source: IDAM, 1999

The principal economic activity of Amazonas is farming. The agricultural activities and kind of crops grown in the state vary due to changing geography and transportation infrastructure.

Generally, vegetable cultivation in the State of Amazonas takes place on both the terra-firme and varzea. According to the IDAM (1999), there are 19 types of economically important vegetables in Amazonas planted on 6,390 ha. There are striking differences among the municipalities in terms of area planted to vegetables. The principal areas of vegetable cultivation are located in the suburbs of Manaus, areas that border the Solimoes River, and Iranduba. Most all of the vegetables grown in these locations are consumed in the area of greater Manaus.

The production of vegetables in Amazonas varies widely from year to year (see Annex 6 Table.1) and is summarized in the table below. For 1999, the production and kinds of vegetables grown still do not meet the rising state demand, even though the State of Amazonas agricultural plan given a high priority to local vegetable production in recent years.

Table 5.5.2-2 State of Amazonas Vegetable Production Data, 1997-1999

Crops	Production			Planted area (ha)		
	1997	1998	1999	1997	1998	1999
Watermelon (1,000fruits)	5,386	5,999	4,970	2,281	2,592	2,759
Cabbage (ton)	1,807	2,754	2,542	154	175	184
Green pepper (ton)	156	425	342	25	41	90
Long beans-meter (1,000bunches)	1,200	ND	1,008	12	ND	26
Okra (ton)	120	132	116	19	19	27
Pumpkin (ton)	131	1,474	2,057	32	202	184
Lettuce (1,000head)	5,032	5,801	9,563	114	107	152
Coube (1,000 bunch)	1,418	1,019	1,875	52	91	90
Coentro (1,000 bunch)	1,118	2,673	5,666	61	164	348
Spring onion (1,000 bunch)	5.196	9,461	25,461	56	113	222
Sweet potato (ton)	600	720	880	649	46	71
Cucumber (ton)	1,001	1,561	5,462	91	134	498
Tomato (ton)	95	167	211	11	22	22
Eggplant (ton)	-	-	468	-	-	18

Source: IDAM Consolidaded Trimester Tables (1997 – 1999)

The above table shows that, except for okra and long bean, the majority of vegetables have experienced significant increases in production between 1997 – 1999.

(b) Production of Vegetables in the Study Area

Annex 5.5.2-1 presents the production figures and planted area of vegetables in all

three municipalities of the study area. The table below summarizes the data for the key vegetable production area, Iranduba:

Table 5.5.2-3 Vegetable Production Data for Iranduba, 1997-1999

Crops	IRANDUBA					
	1997		1998		1999	
	Prod.	Share (% State)	Prod.	Share (% State)	Prod.	Share (% State)
Watermelon (1,000fruits)	57	1.1	225	3.8	381	7.7
Cabbage (ton)	128	7.1	416	15.1	384	15.1
Green pepper (ton)	20	12.8	372	87.5	288	84.3
Long beans-meter (1,000bunches)	1,200	100.0	ND	ND	1,008	100.0
Okra (ton)	-	-	-	-	-	-
Pumpkin (ton)	-	-	400	27.1	900	43.7
Lettuce (1,000head)	-	-	309	5.3	1,302	13.6
Coube (1,000 bunch)	-	-	374	36.7	88	4.7
Coentro (1,000 bunch)	90	8.1	252	9.4	972	17.2
Spring onion (1,000 bunch)	1,820	35.0	126	1.3	252	1.0
Sweet potato (ton)	-	-	-	-	-	-
Cucumber (ton)	-	-	340	21.8	1,340	24.5
Tomato (ton)	-	-	108	64.6	108	51.2
Eggplant (ton)	-	-	-	-	468	100.0

Source: IDAM Consolidaded Trimester Tables (1997 – 1999)

According to the data obtained from IDAM, Iranduba produces a high percentage of the State's vegetable crop, and is the only location where significant amounts of eggplant and long bean appear to be grown. Generally, it appears as though couve and spring onion are declining in production.

In contrast to this, the vegetable production of the other two study areas, Itacoatiara and Maues are quite limited. Only the production of watermelon is shown in the statistics concerning the vegetable production in Maues. The figures for vegetable production in Itacoatiara are very low, almost nonexistent.

(2) Location of the Main Vegetable Production Area in Iranduba

The municiparity of Iranduba is classified into two agro-ecological zones namely, Várzea (the holm land) and Terra-firme (the firm land). The major soil in the Terra-firme is Yellow Latosol which is a low fertility soil due to low mineral material, while the soils in the várzea are Gray Eutropic Low Humid and Eutropic Alluvial which are very common in várzea, with better chemical properties than soils in Terra-firme.

Fruit cultivation and cattle breeding are well developed in Terra-firme. There are some advanced farmers farming on terra-firme with high technology like greenhouse culture (Plasticulture). Plasticulture in the Terra-firme is practiced on about 19ha at present. These farmers have the resources to purchase fertilizer and agrochemicals, and easy access to the market.

The Main Vegetable Produce Area in Iranduba is localized along the Solimões River. This area is characterized as the Várzea, which has vast areas inundated when water rises to high levels. The location of the main vegetable produce areas in Iranduba is

shown in Figure 5.5.2-1 and the name of communities located in Várzea are listed below (Table 5.5.2-4).

Table 5.5.2-4 Main Vegetable Produce Areas in Várzea

No.	Localidade	Communty
5		Catalao, Costa do Catarao, Paracuuba, Xiborena, Vila Nova
6	Costa do Iranduba	Divino Espito Santo, São Francisco, São João, 7 de Setembro
7	Ilha do Baixio	Renascer, Santa Luiza
7A	Ilha do C. S. Ta Luzia	Maria Antonia
8	Marchantaria	São Francisco, Santa Luzia, São Lazaro I, São Lazaro II, São José, São Sebastiao
9	Ilha do Jacurutu	São Francisco, São José
10	Ilha do Muratu	Muratu
11	Ilha Paciencia	São João Batista, Nossa Senhora de Fatima, Nossa Senhora da Conceicao
12	Costa do Caldeirao and Manacabura	Jandira, São João, EMBRAPA, Vila Cavalcante

Source: IDAM, Iranduba Local Unit

(3) Land Use and Holding Size

The main crops found in Iranduba are, cassava, indian corn, guaraná, fruit trees and vegetables. The staple food of the State is cassava which is processed into farinha. The planted area of cassava occupied 350 ha in total, and most of the production is consumed by farmers. Fruit trees such as passion fruit, orange, papaya are popular, and planted in both várzea and terra-firme for marketing in local consumption. Vegetables such as cucumber, sweet pepper, cabbage, lettuce, coreander, long beans, water melon, leaf cabbage are cultivated in scattered land and mostly concentrated to várzea. The total area cultivated is more than 500 ha, and these vegetable are mainly produced for marketing to Manaus. The area used for agricultural production in Várzea is estimated at about 30% of the total production area.

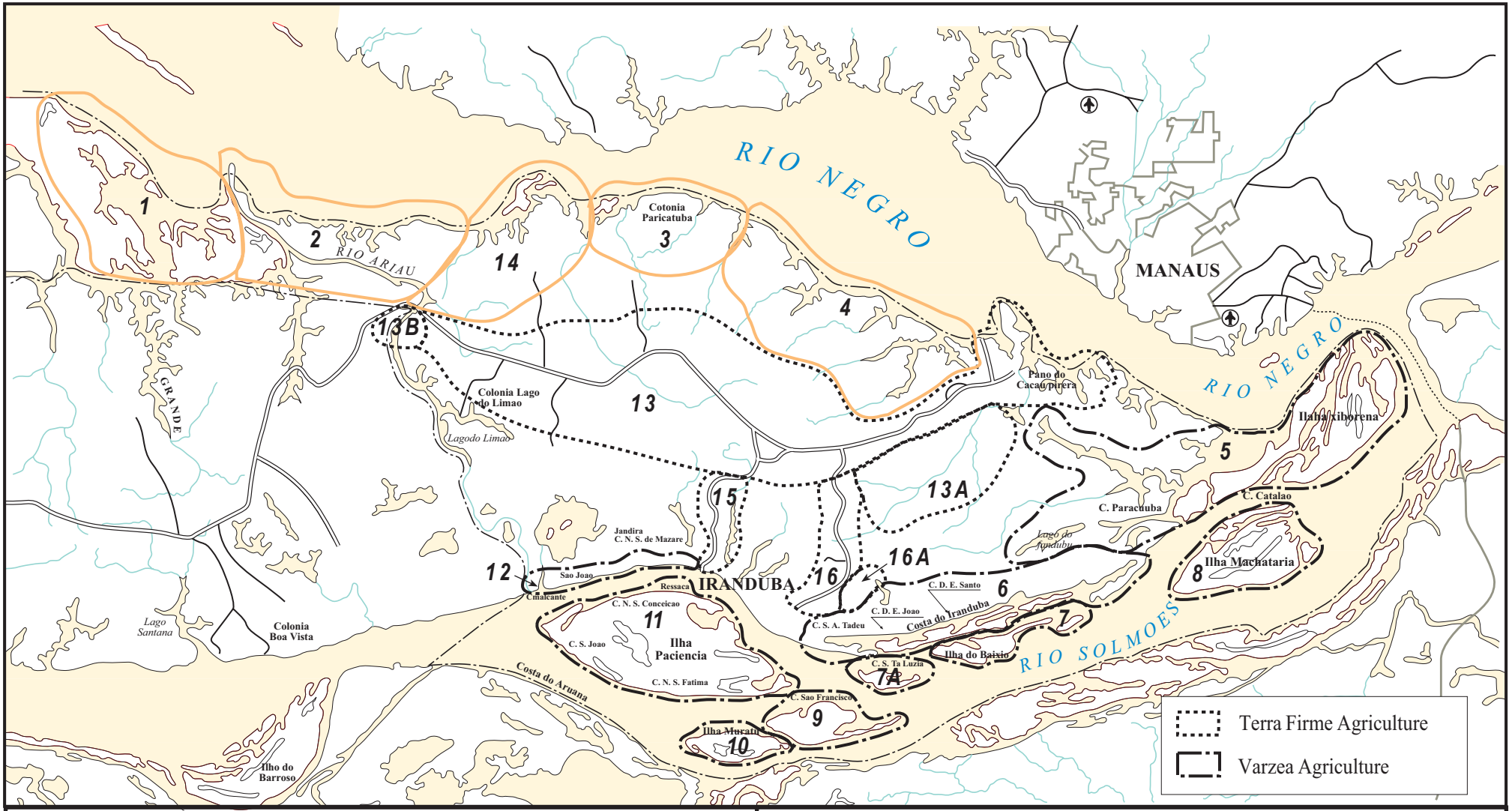
The agricultural land use of Iranduba is summarized in Table 5.5.2-5.

Table 5.5.2-5 Agricultural Land Use of Main Crops in Iranduba

Crops (Fruits, Grain, Tube)	Area (ha)	Crops (Vegetables)	Area (ha)
Cassava	350	Water Melon	137
Guaraná	74	Cabbage	43
Corn	282	Sweet Pepper	42
Pupunha	178	Pumpkin	40
Banana	70	Spring Onion	22
Passion Fruit	71	Lettuce	26
Papaya	205	Green Cabbage	9
Orange	120	Coriander	64
		Cucumber	69
		Tomato	9
		String Beans	26
		Egg Plant	18

Source: Plan of Operation Municipality Iranduba, IDAM

According to the available IDAM statistic data, in the municipality Iranduba, 51% of the farmland is occupied by small farmers who have land holdings of 20.5 ha and cultivated land of 2.5 ha in average (see Table 5.5.2-6). The socio-economic survey also shows the similar tendency. The holding area varies from 5 ha to 19.9 ha (average 18.5ha), and cultivated areas are between 0.1 to 4.9ha (average 2.75ha).



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Japan International Cooparation Agency (JICA)

Figure 5.5.2-1
Location of Vegetable Produce Communities in Iranduba

5 - 45

Table 5.5.2-6 Average Planted Area in Each Association

Association	Planted Area (ha)	No. of Producer	Planted Area per Production (ha)
São João (Jandira)	240.5	107	1.91
Nossa Senhora de Nazare (Jandira)	144.0	86	1.67
Muratu	29.5	6	4.92
Jacrutu	81.0	20	4.05
São Judas Tadeu	38.0	12	3.17
7 de Setembro	99.5	44	2.26
Renascer	43.0	16	2.69
São João	91.0	41	2.22
Estrada da Várzea	147.5	37	4.72
Ilha da Paciencia	56.0	22	2.55
N. SRA. Conceicao (Ilha Pacoiencia)	45.0	16	2.81
Do Paracuuba	38.0	17	2.24
Ilha do Baixio	45.0	17	2.65
Da Maria Antonia	30.0	9	3.33
Total	1,119.0	450	2.49

Source: Plan of Operation Municipality Iranduba, IDAM

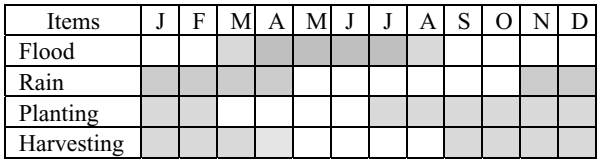
(3) Cropping Pattern and Farming Practices

In Manaus and its neighboring Municipalities, the highest water levels of the river are reached between April and July. Nevertheless, these lands are annually cultivated for 5 - 8 months. But in some years, (when the flood doesn't reach the high várzea) it's possible to delay the period of cultivation. This delay occurs when the flood level doesn't reach 27 meters (measured by the port of Manaus). This level is considered dangerous for agricultural use of the Solimões River's várzea. (Cravo & Smyth, 1991).

Due to the short period that soils are able for agricultural use (five to eight months per year), these areas are reserved for the cultivation of short cycle species, such as vegetables, corn, bean and some varieties of cassava. Pasture land is also important, when Cattle Raising is an integral part of the system.

The agricultural cropping season in the area is August– April. During this period, the entire crop cycle has to be completed (clearing, planting, harvesting and packing for storage, selling). The flooding season marks agricultural activity very difficult but it enriches the soil.

Monoculture and mixed cropping is practiced. Crops are grown in small plots. The cultivation of some vegetables such as lettuce, spring onion and coriander is repeated several times during the season. Some farmers divide planting into several periods in order to continue the harvest and disperse the labor requirement. Figure 5.5.2-2 shows the outlines of the cropping calendar.



Source: Farm economic Survey, Interview Survey, 2000

Figure 5.5.2-2 Typical Cropping Calendar in Iranduba

The equipment used in Iranduba agriculture is extremely basic - it consists of simple rudimentary tools like hoes, axes, sickles, etc. Processing is also almost totally artisanal (manual) - using traditional techniques. Farm activities are organized on a family basis. Generally, only family labor is used. The average labor force is 2-3 persons per family. During the period of land preparation of the area, planting and harvest the farmers hired labors.

The Majority of farmers do not use any kind of fertilizer at all. However, there is extensive use of agro-chemicals in the area, necessitated by the high incidence of pest and disease. There is a great reliance on family and relatives for labor. There exists only incipient technical and financial support.

During the flooding period (March to July), some producers continue cultivating vegetables on suspended beds and cattle breeder transport the cattle to pastures higher ground (terra firme), or they build marombas flutuantes (floating corrals), where they confine the animals until the pastures are ready again in the várzea.

The principalbcrops farmed in the Iranduba area are summarized in Table 5.5.2-7.

Table 5.5.2-7 Actual Farming Practices for Vegetables in Iranduba

Crops	Planted Area (ha)	Spacing (m)	Cycle per season
Watermelon	0.27-1.42	3.0-2.0	1
Cabbage	0.3-0.33	0.8-1.0x0.4-0.6	1-2
Green pepper	0.5-0.14	1.0-1.5x0.5-1.0	2
Long beans		1.0x0.5	1
Okra		1.0x0.5-1.0	1
Pumpkin	0.26-0.63	3.0x3.0	1
Lettuce		0.3x0.3	3
Leaf Cabbage	0.09-0.3	1.0x0.4-0.5	3
Coriander		0.2x0.3	3-
Spring Onion	0.02-0.08	0.21-0.25X0.25	1
Cucumber	0.11-0.35	1.0x0.5-0.6	2
Tomato	0.02-0.27	1.0x0.5-0.6	1
Eggplant		1.0x1.0	1

Source: EMBRAPA, IDAM HQ, Interview Survey by Study Team, 2000

(5) Pests and Diseases

At the initial stages of cultivation, the young vegetable plants are attacked by many insects such as crickets, locusts, caterpillars, and larvae of the diamond back moth. Most of farmers apply agro-chemicals when they think the pest and disease population threatens the crop yield – but unfortunately mainly of their decisions are not based on proper pest scouting and the chemicals are misapplied. Also, application may be more driven by the farmers available “cash in hand” as opposed to the actual need to apply. According to the farmers in the area, very toxic chemicals such as folidol (methyl parathion) and other “Highly Hazardous Class 1b” chemicals are being routinely used. These chemicals are readily available from shops in Manaus. The major pest and diseases and agro-chemicals used in Iranduba are as follows:

a. Insects:
   crickets, locusts caterpillar, mole cricket, mite, thrips, acarids, cutworms, nematodes

b. The Principal Insecticides:

Bacillus thuringiensis, deltamethrine, triclorfon, diclorvos, methyl parathion, mevinphos, methamidophos

c. Diseases:

Bacterial:

bacterial wilt, bacterial soft rot, bacterial spot

Fungal:

damping-off, leaf spot, southern blight

d. The Principal Fungicides:

copper oxichloride, mancozeb, benomyl.

(6) Yield of Vegetables

The majority of small farmers use traditional techniques. These small farmers suffer from lack of their own capital and very few of them can access credit, receive technical assistance, or use modern input. Furthermore, the production of vegetables in Várzea is influenced by the yearly fluctuation of tide, pests and diseases. As the result, both the productivity and quality of the vegetables always remain at a low level. The yields of some of the major vegetable crops are summarized in Table 5.5.2-8.

Table 5.5.2-8 Actual Yield and Expected Yield of Main Vegetables

Crops (Unit)	Yield	Expected yield
Watermelon (1,000fruits)	3	5 - 6
Cabbage (ton)	12	20
Green pepper (ton)	12	10 - 16
Lettuce (1,000head)	62	78
Coriander (1,000 bunch)	18	25
Cucumber (ton)	20	12 - 26
Tomato (ton)	12	16
Eggplant (ton)	39	40

Source: IDAM Comsolidaded Trimester Tables (1999)

For the typical producer, both the quantity and quality influences his yield greatly. In the case of vegetables, it is thought that there are major losses in quality which greatly affect income.

Market research was performed for the objective of obtaining information about the quality of products, which affects both price and the quantity of production. In the main markets of Manaus, a questionnaire survey of about 600 middlemen were conducted by the study team during the last field survey and the present field survey period. As a result of a brief analysis of this field survey, a certain tendency about the quality of vegetables was obtained. There is a tendency that the leaf vegetables (lettuce, coriander, spring onion) produced in Iranduba have a very high value. In contrast, fruit vegetables from São Paulo, such as a tomato, had a much higher vale than local vegetables. As for other main vegetables such as cabbage, green paper and eggplant the value was divided. It is judged that these results suggest that future resources should be directed towards the improvement in quality of vegetables and by consumer taste. Detailed analysis should be performed and the results should be utilized for future vegetable selection for the plan formulation.

(7) Features of the Iranduba Agriculture

In the finding and information obtained through this investigation, the most important points are described below.

(a) Low Profitability

Many farmers are complaining that vegetable profitability is too low. This is no doubt that a high production cost is as one of the main reasons. The high cost of inputs is a constant complaint of the farmer in this area. Seed prices for vegetables are especially cited as high. The high hired labor cost (R$10/day and full meal) also reduces the profitability of crops. Also, the producers are not organized within the communities, which makes the farming activities more difficult.

The farmers are well aware of the low productivity and low quality of their products. This is caused by many problems, mainly the lack of knowledge and technology resulting in high yield loss. There is also inappropriate use of fertilizers, manure and agro-chemical. Low profitability means higher production costs for the farmers, loss of produce and low quality of product.

Agricultural research programs are necessary for the purpose of ensuring good cultivation, improving the efficiency of use of the land, and reduce the costs of production for the main annual crops in the study area. At the same time, the improvement of extension activities is also an important future project component. Moreover, farmers participation in the extension and research activity is also necessary in order to improve the efficiency of the extension activity.

Good results from an improved support activity will not be obtained without strengthening of the farmer organizations. Strong organizations can greatly improve farmers profitability by activating systematic group activities, such as group sales, group purchases, and the communalization of agricultural work.

(b) Soil Fertility

In the várzea, the annual flooding deposits rich sediments in minerals and renew the soil, and making it very fertile. The soil of the várzea is distinguished by its high fertility and low acidity. However, in spite of showing good natural fertility, the majority of the várzea from muddy water rivers of the State of Amazonas, is insufficient in nitrogen. The contents of Organic Carbon (C) and Total Nitrogen (N) in its soils are relatively low. The analysis results of the soils of várzea from Paraná do Ramos (Barreirinha) showed contents of Organic Carbon, around 0,14% to 2,33% and contents of Organic Nitrogen around 0,05% to 0,19% (Corrêa & Bastos, 1982). Although the value of the relation C/N (around 3 to 28) exposes good capacity of mineralization of Organic Nitrogen, the low contents of Total Nitrogen indicates that the natural reserve of N in the soil is limited.

In the fruit orchards of the várzea, one finds some signs of nutritional deficiency and problems with diseases. With papaya and cabbage, boron deficiency was observed, causing the deformation of fruits and reducing the commercial value. Passion-fruit trees and coconut trees show insufficiency of nitrogen and banana trees show insufficiency of nitrogen and high disease attack. Despite these problems acceptable yields of these crops can be obtained in this ecosystem.

In the study area, detailed soil survey with chemical analysis is seldom performed and the chemical properties of every area is not clear. In order to recommend the most suitable farming technologies for the soils of the study area, many soil surveys and chemical analysis needs to be performed.

(c) Agro-chemical

There is extensive use of pesticides in the study area, necessitated by the high incidence of pests and diseases. There is a high degree of agro-chemical mismanagement which results in serious problems, for the producer's and consumer's health. The stability of the ecosystem is also upset, which further aggravates the problems with pests and diseases. Phosdrin, the fungicide Manzate and most of the pesticides, are highly toxic (Mevinphos, Parathion methyl, Metamidophos and Diclorvós) and risky to use, mainly in the absence of specialized technical assistance.

Furthermore, a common problem in all agricultural activities of the várzea, is the infestation of weeds, mainly in areas of continuous cultivation. Due to this, some farmers have been using herbicide, without any orientation about the use, dosage and necessity of protection.

However, these chemicals are almost always bought without adequate guidance on their use. The questionnaire survey and field observations shows that there is little or no orientation on the use of pesticides, and the farmers take very few precautions. The information provided by the extension service on the cultivation techniques, application equipment, and proper application equipment are all rudimentary.

Extension services are urgently and promptly needed by all the farmers farmers, but the visits provided by IDAM are very infrequent. IDAM realizes its own limitations and is very concerned about the long term effects of pesticides on the Iranduba environments.

(8) Distribution and Processing

(a) General Aspects:

This section of the report will discuss some of the general aspects of processing, distribution, and marketing which affect vegetable growing communities in Iranduba. After the general aspects are discussed, a more focused description of the problems affecting the three localities visited by the RRAQS team will follow.

The processing, distribution, and marketing of crops from Iranduba is distinct from the other two municipalities of Itacoatiara and Maués in several important ways:

- Due to the focus on selling vegetable cash crops in the Manaus market, much fewer subsistence crops (such as cassava, banana, cara) are planted by the farmers.
- Currently, there is extremely limited processing of any agricultural crops in the municipality of Iranduba.
- Post harvest and distribution activities are largely dependent upon the dynamics of the river, and the appearance of varzea production areas. Distribution of vegetable crops from the varzea areas to Manuas is limited to the months of September through March when the water levels of the Solimoes River are low. Distribution from terra-firme areas is far less important.

(b) Processing:

The only kind of processing being performed on Iranduba vegetables is so called "minimal processing". Minimal processing is defined as operations in which undesirable, inedible parts of the vegetable (such as husks, outer leaves, stems, and seeds) are removed by cutting, which is usually followed by further cutting of the edible parts into smaller sizes that are more suitable for immediate consumption. So that the product does not lose a significant amount of freshness after cutting, minimal processing usually involves some kind of packaging technique as well (usually shrink wrapping over styrofoam trays).

In the case of vegetables that are grown in Iranduba and marketed in Manaus, the only distribution points which currently use minimal processing are the supermarkets.

(c) Distribution:

The overall post harvest distribution pattern of Iranduba vegetables is quite clear: all are transported to Manaus by boat where over 90 % are consumed locally. There is minor consumption in Iranduba proper, and a few vegetables are shipped on the river to other municipalities via brokers.

There are three basic categories of vegetable farmer in the JICA target area of Iranduba. Factors, which determine a farmer's category, are the size of the farm, level of technology used, ease of access to markets, and how the harvest is distributed. The basic farmer categories are described below:

<u>Type I Producer</u>

Small producer who farms 0.5-2 hectares, mainly during the varzea season. Uses practically no fertilizer or agrochemicals. Has no control over the transport and sale

of the crop. Totally dependents on selling to traders (intermediaries) who arrive at the farm, negotiate a price, and then haul the away the crop (normally by boat). These traders may resell the crop in local Iranduba markets or in Manaus markets. Some Type I producers belong to small farmer cooperatives and thus have limited access to more guaranteed marketing mechanisms.

Type II Producer

Medium size producer who farms 1- 3 ha and may have at least one simple greenhouse operation. Has plantings in both terra firme and varzea. Knows how to use fertilizers and agrochemicals and uses them selectively on certain vegetables if he has cash available. Will often sell through traders but prefers to rent a truck or boat in order to take his own crop to market. Generally sells to open markets and fairs in Manaus, and to wholesalers.

Type III Producer

Medium - large scale producer who farms in excess of 3 ha and generally has multiple greenhouses (3-8). Normally has a high percentage of his farming on terra firme, focusing a lot of attention on greenhouse activities. Has the resources to purchase fertilizer and agrochemicals but often mismanages application of these inputs. Generally uses too little fertilizer and too much agrochemical (especially insecticides). Will own a minimum of one truck and boat in order to have control over transport of the harvest. Generally sells to the open markets and fairs of Manaus, wholesalers, hotels, and supermarkets.

Based on these three basic categories of farmer, it is estimated that the general distribution pattern of Iranduba's vegetable crop is shown in Table 5.5.2-9.

Table 5.5.2-9 Post Harvest Distribution Chain of Iranduba Vegetable Crops, July 2000

Distribution Point	Source (Producer Type)	% (Total Iranduba Crop)
Iranduba Markets (direct sale)	I, II, III	3
Iranduba Markets (sale via brokers)	I, II	7
Manaus Markets/Fairs (direct sale)	II, III	10
Manaus Markets/Fairs (sale via brokers)	II	22
Manaus Wholesalers (direct sales)	II, III	5
Manaus Wholesalers (sale via brokers)	I, II	25
Manaus Supermarkets (direct sale)	III	10
Manaus Supermarkets (sale via brokers)	II	5
Manaus Hotels (direct sale)	III	5
Manaus Hotels (sale via brokers)	II	3
Outside Manaus (sale via brokers)	II, III	5
TOTAL		100
TOTAL (DIRECT)		33
TOTAL (BROKERS)		67

Source: Personal communication with Iranduba farmers, IDAM, Manaus supermarkets

Further study needs to be done during the third phase of fieldwork to quantify the exact percentage of Iranduba sales to each of these key distribution points. The principal distribution points are further defined as follows:

Iranduba local markets: Various local points of sale, 2 principal sites

Manaus Markets/Fairs: Feira da Panair, Adolfo Lisboa, Manaus Moderna, Compensa II, Santo Antonio, Alvorada I, FPZ Leste

	JT, Coroada, Feira de Banana
Manaus wholesalers:	CEASA, MM de Freitas, S. Fuji Ltda, Marcos Rocha, AR Sombra, Pedro Kina, PC Maia, M.Nakamura, GF Silva
Manaus supermarkets:	Carrefours, D.B., C.O., Casa Roma
Manaus hotels:	Hotel Tropical, Da Vinci Hotel, Amazonas Hotel, Novotel, Holiday Inn/Taj Majal, Hotel Amazonas, Slaass Hotel, Hotel de Selva, etc.

Thus an estimated 67% of Iranduba's vegetable sales are brokered through intermediaries. Very few sales are actually being transacted directly between the farmers and the final point of sale. This is mainly because most of the Iranduba vegetable farmers are poorly organized, isolated due to the river environment and/or poor access roads, and generally lack incentive to pursue the difficulties of direct marketing.

5.5.3 Tropical Fruits

(1) The Priority Tropical Fruit Crops

Four tropical fruits were targeted as "priority crops" to receive project support in the municipality of Itacoatiara. These crops were chosen by mutual agreement between IDAM and JICA during the initial feasibility study that led to the Inception Report.

Cupuacu (*Theobroma grandiflorum (Wild. Ex Spreng) Schum*) was chosen as the lead crop since Itacoatiara is one of the highest production areas for that fruit in Amazonas. It grows very easily in the area and but suffers from quality problems and lack of processing capacity. Itacoatiara has a competitive advantage in cupuacu production which needs to be maintained.

Banana (*Musa spp.*) grows naturally in the area and is widely important both as a cash crop and a staple food crop. Older varieties are under severe disease attack, so an opportunity arises to establish new, resistant varieties as long as consumers will accept them.

Acai (*Euterpe oleracea Mart.*) grows well in the natural forest agroecosystem of Itacoatiara but is not as prevalent as cupuacu or banana. It is relatively easy to grow and can be harvested for its fruit or palmito; both can be processed into a variety of products. There is considerable farmer interest so it is a crop of opportunity.

Maracuja (*Passiflora edulis F. Flavicarpa*) is a high value fruit crop that has been recently introduced to Itacoatiara. It is difficult to grow but very easy to sell, and thus represents an opportunity for small farmers to generate more income. Farmers must learn fairly intensive management techniques in order to grow it properly.

Note on Sustainable AgroForestry: Another reason why these four crops were

chosen was the need to promote their use in SAF systems. All indications are that they are compatible in many ways for a mixed farming approach. It will be important to find the best high value hardwood species (such as mahogany and loro) which can be grown together with these fruits.

Note on Other Fruit Crops: It should also be noted that pineapple and pupunha are also very imortant fruit crops in the Itaicoatiara area, but these were not chosen as priority crops due to time and resource limitations of the Study.

(a) Crop Characteristics

The general characteristics for each of the four fruits is summarized in Table 5.5.3-1. These characteristics emphasize the existing condition of the fruits in the Amazonian environment, and include information on:

- Scientific name, family name
- Origin
- Climate
- Soil
- Irrigation/Drainage
- Pests/Diseases
- Cultural Practices
- Processed Products
- Yields/Harvest Schedule
- Potential

(b) Production Data

Production information for the specific region of Itacoatiara is very limited, therefore some information is presented at the state and regional level in the following text, and in Tables 5.5.3-2 through 5.5.3-3:

Table 5.5.3-2 National and Regional Production (tons) of Tropical Fruits

	Banana*	% Total	Acai**	% Total	Maracuja +	% Total	Cupuacu++
BRASIL	4,688,288	100	151,886	100	3,382,243	100	n/a
NORTH	1,172,694	25	146,524	97	1,091,091	32	n/a
Rondonia	169,504	3	0	0	8,461	0	n/a
Acre	38,248	1	69	0	2,732	0	n/a
Amazonas	454,190	10	618	1	7,820	0	2,571
Roraima	17,480	0	2	0	0	0	n/a
Para	461,480	10	144,412	95	1,071,754	32	n/a
Amapa	0	0	1,422	1	0	0	n/a
Tocantins	31,792	1	1	0	324	0	n/a
OTHER	3,515,594	75	5,362	3	2,291,152	68	n/a

Source: IBGE; *1997; **1996;+1995; ++1999

Table 5.5.3-1 Target Crops (Tropical Fruits) Characteristics (1/2)

	BANANA	AÇAI	CUPUAÇU	MARACUJÁ
Scientific name	*Musa* spp.	*Euterpe oleracea* Mart.	*Theobroma grandiflorum* (Willd. Ex Spreng) Schum	*Passiflora edulis F. Flavicarpa*
Family	*Musaceae*	*Arecaceae* (Palmae)	*Sterculiaceae*	*Passifloraceae*
Origin	Asia	Amazon Region	Amazônia Oriental	Native of Brasil
Climate	Tropical, temperature in the range of 18º to 28ºC: Rainfall in the range of 100 a 180 mm/month	Tropical, temperature in the range of 18º to 28ºC. rainfall in the range of 2.000 a 2.700 mm per year, well distributed. Extremely exigent in solar radiation which affects fruit production.	Mean temperature ranging from 21,6ºC to 27,5ºC, relative humidity in the range of 77% to 88% and precipitation in the range of 1.900mm a 3.100mm well distributed.	Prefers hot and wet climates, it grows well in subtropical climates. Temperature ranges from 23 to 27ºc, low relative humidity and precipitation in the range of 800 to 1750mm well distributed during the year.
Soil	Level to rolling land topography. The ideal soil is alluvial, deep, rich in organic matter, well drained and with high water holding capacity. Ideal pH ranges from 6.0 to 6.5.	It grows in a wide range of soils in the area from the glei-húmidos (hydromorphyc – várzeas e charcos) to the Latossolos amarelo (Terra firme). pH range from 4,5 to 6,5. Prefer soils with high organic matter and good water retention.	Terra Firme soils with good physicsl chararacterists and good water retention. Good internal drainage.	Deep, fertile and well drained soils.
Irrigation	Extremely water exigent but it does not tolerate water logging. Water requirements ranges from 100 to 180 mm/month or more. With the appearance of Black Sigatoka disease it is recommended to use localized irrigation methods like trickle.	It is cultivated in the varzeas tolerating non permanent flooding.	Flowering and production is affected by soil moisture. Irrigation could help to stabilize production.	Trickle with at least 7 days frequency, depending of weather.
Drainage	Banana trees do not allow flooding for more than 3 days. Water table should deeper than 1.2 meters.	Only to control permanent flooding	Need good drainage. Do not tolerate flooding	Needs good drainage
Pests	banana root borer (*Cosmopolites sordidus*, Germar); Thrips (*Tryphactothrips leneatus*, Hood) and (*Caliothrips bicinctus*, Bagnall); Flower Thrips (*Frankliniella* spp.); Traça da bananeira (*Opogona sacchari*, Bojer); banana aphid (*Pentalonia nigronervosa*, Coquerel); Leaf caterpillar (*Caligo* spp., *Opsiphanes* spp., *Antichloris* spp.); Vasp (*Trigona speripes*, Fabr.); Scales (*Tetranychus urticae*, koch e *Tetranycus ludeni, Zacher*).	Black scales (*Cerataphis lataniae*); caterpillars	Fruit borer (*Conotrachelus* sp), Leaf Caterpillar (*Macrosoma tipulata*), bud borer (*Coleóptera:Curculionodae*), ants	Caterpillar of leaves *Agraulis vanilae* e *Dionae juno juno*), bed, beattles
Diseases	Yellow Sigatoka (*Mycosphaerella musicola, Leach*); Black Sigatoka (*Mycosphaerella fijiensis, Morelet*); Panama disease (*Fusarium oxysporum f. sp. Cubense*); Moko (*Ralstonia solanacearum, raça 2*). Rhyzome rot (*Erwinia carotovora, Jones*); *banana bract mosaic(BBRMV*);*banana bunchy top virus (BBTV*); *cucumber mosaic virus(CMV*); *banana streak virus(BSV*).	Short leaves desease	Withes broom (*Crinipellis perniciosa*), Progressive death (*Lasiodiplodia theobromae*), red rotteness (*Gonoderma philipii*), Phomopsis stain(*Phomopsis* sp)	Tombamento (*Pithium*) Anthracnose (*Colletotrichum gloeosporiodes*) Bacteriosis (*Xanthomonas campestris*), warty (*Clodosporum herbarum*), rot (*Phytophthora cinnamoni*), Wilt (*Fusarium oxysporum*)
Tillage Practices	Weed control, thinning, leave cutting, organic and inorganic fertilization, bracing of bunch, cutting of stem after harvest.	Weed control, cultural contrl, thinning, fertilization.	Wee control, crowning , mulchin, fertilization, sanitary pruning.	Weed control, formation and renewal prunning, fertilization, irrigation, supporting.
Spacing	Small trees: 2,5m x 2,5m ou 4m x 2m x 2m; Medium size trees: 3m x 3m. It is recommended the equilateral triangle to have the most light, better air flow and to optimize area use by planting 14% more plantas.	For fruit production 5m x 5m spacings are recommended. For “Palmito” production could be denser : 2m x 2m.	7m x 7m in equilateral triangle.	Vertical support: 4 – 6m Upper support 2,5 – 3m

Table 5.5.3-1 Target Crops (Tropical Fruits) Characteristics (2/2)

	BANANA	AÇAI	CUPUAÇU	MARACUJÁ
Products	Banana chips, Banana puree; banana nectar; doce de banana em massa; mariola; banana juice; banana em calda; banana flour; dedydratated banana;banana flakes; banana liquir; banana wine; bnana vinager; banana beera; banana aguardente; organic manure; ornamental paper.	**Fruits:** juice, cream, icecream, liquor, jelly, "mingau", leather finisshing, organic manure, alcohol, oil, medicinal. **Palmito:** pickles, salad, creme, animal food **Leaves:** housing roof, walls, basket, carpet, hat, wake, celulose, animal food, organic manure, mulch and shade for nurseries and crops. **Bunch: organic manure**. **Roots:** vermífuge	**Pulp:** juice, icecream, paste,cream, preseerve, liquor, jelly, néctar, yogurt, biscuit, pudim. **Seeds:** cupulate, cosmetics, medicine. **Pill:** organic manure, handcraft	Juice,, icecream, sweet, cream, preserves, liquor, jelly, yogurt, biscuit, medicinal.
Yields	'Maçã' (AAB) – 10 t/ha/cycle 'Prata' (AAB) – 13 t/ha/cycle 'Prata anã' (AAB) – 24 t/ha/cycle 'Pacovan' (Plátano - AAB) – 15 t/ha/cycle 'Caipira' (AAA) – 20 t/ha/cycle FHIA-18 (AAAB)* - 24 t/ha/cycle FHIA-01 (AAAB)* - 30 t/ha/cycle * Híbridos da Fundação Hondurenha de Investigação agrícola.	Terra Firme: 10-12 tond of fruits/ha Varzea: 15 t/ha; For Palmito yiel is 2.000 plants/ hectare/ano.	Mean of 26 a 37 fruits/plant. A 1,2 kg fruit produces 450 g of pulp.	14 t/ha/year
Harvest months	Al year. In the first cycle harvest is done from 10th to 12th month, depending on variety. After that if well managed there are two cycles per year.	Peak is from August to January	From November to June with peak from February to march.	All year
Potentiality	Banana is the most consumed fruit in Amazonas being part of popular diet of people. Demand is higher than offer and therefore there is importation from other states. Beside fresh consumption, there are many products that could be made from banana making this crop of great potential and having the opportunity to have add value to product.	Açai has a good chance to become an economical crop. On farm processing will allow to have add in products, utilization of local hand labor and stabilizing income and offering a better quality products. Açaí juice tends to conquer other brazilian markets. Palmito market is also promising. Brazil occupies the position of biggest producer and consumer of this product. Export possibilities are great but has not been explored.	Demand is increasing in other regions of the country mainly pulp and juice. International demand is starting.	Local, national and internaional market.
Limitation	Fresh product commercialization, diseases, technical assistance, farmers organization and crop management are main limitations.			

Sourse: IDAM

Table 5.5.3-3 Production (tons) of Tropical Fruits in Study Municipalities, 1999

	Itacoatiara	Iranduba	Maues	Manaus	Amazonas
Cupuacu*	608	0	184	1,028	2,571
Cupuacu Pulp	0	0	0	382	663
Maracuja	270	324	56	2,942	3,871
Maracuja Pulp	0	0	0	883	916
Acai **	0	0	0	0	240
Banana***	237	168	720	0	5,568
Total	1,118	492	2,304	5,235	

Source: IDAM
*Assumes average fruit weight is 800 gr
** Assumes average bunch weight is 5 kg
*** Assumes average bunch weight is 8 kg

i) Cupuaçu

Cupuacu is found distributed throughout all of the Brazilian Northern States, with the heaviest concentrations in Para and Amazonas. Over 2500 tons of fruit were harvested in Amazonas State in 1999, primarily in the municipalities of Rio Preto da Eva, Humaita, Autazes, and Apui. As for this Study Area, in 1999 Itacoatiara and Maues produced 608 and 184 tons, respectively, whereas Iranduba production is nearly nonexistent. Amazonas produced over 600 tons of cupuacu pulp in 1999 and over half of this was processed in the Manaus area (Table 5.5.3-3).

Cupuaçu production is recent and is growing fairly fast. IDAM is assisting 700 producers on 1900 has, indicating that size of planted area for each farmers is very small, 2.7 ha. The fruit is used in many products to make juices, deserts, ice cream, cupulate and others. Detailed information on processing can be found in another section. Main limitation for the crop is market prices, Witches Broom disease, lack of processing and technical assistance. General limitations like lack of infrastructure and services also affects production.

ii) Acai

Acai is widely distributed throughout the countries of South America, but Brazil is the leading producer with over 150,000 tons harvested in 1996. Over 90 per cent of Brazil's production occur in the Northern State of Para alone. Amazonas only produces 1% of national production, most of which is produced in the municipality of Codajas. Acai is currently a very minor crop in the three municipalities of the Study Area, although it has a lot of potential for expansion. Açai is a new crop for the area. Açai has many uses, mainly beverages.

iii) Maracuja

Brazil is the world's leading producer of maracuja with about 3.4 million tons recorded in 1998. Unlike cupuacu and acai, maracuja has been able to flourish in some subtropical climates of the south (São Paulo, Bahia, Minas Gerais)

where over 65% of the crop is currently grown. However, the Northern State of Para is still the largest individual production area with over one million tons harvested in 1995. Production in Amazonas State has dropped from 7820 tons in 1995 to about 4000 tons in 1999. Of the 4000 tons, about 663 were processed into pulp and over 95% of this pulp was processed in the Manaus area. All three municipalities of the Study Area produce maracuja but there is very little pulp processing activity.

Maracuja is a traditional crop of the area. It is mainly used to prepare juice and beverages. Maracuja has very little area planted in the area. IDAM is assisting 97 producers on 45 hectares with an average area of 0.46 ha per farmer.

iv) Banana

Banana is grown in every Brazilian State. In 1997, Brazil was the world's leading producer of banana with a production of over 4 million tons. Currently, Brazil ranks second in world production behind India. Like maracuja, banana also flourishes in subtropical regions in southern Brazil where currently 75% of Brazil's production is grown. Banana is widely grown throughout Amazonas and can be found in all three of the Study Areas, with Maues leading production at over 700 tons in 1999 (Table 5.5.3-3).

Banana is a traditional crop of the Brazilian diet. Production is small and some fruit is imported from other states. It is use mainly as a fresh fruit, although in the project area, plantain are use to prepare several dishes. IDAM is assisting 260 producers on 450 has, with average area of 1.7 hectares per farmer. The presence of Sigatoka and Moko diseases is a very limiting factor for the crop. New hybrid varieties are being introduced but market acceptance is still uncertain. Table 5.5.3-3 presents a summary of present situation of the crop for the project area.

(2) Existing conditions for fruit crop production in Itacoatiara

A general diagnostic of tropical fruit production was conducted to characterize the existing conditions which influence crop production: climate, soils, topography, crop management and external factors. Following is a brief description on those factors. Factors that affect all crops will be analyzed and then particular problems will be detailed. It has to be emphasized that specific information for Itacoatiara is very limited, therefore some conclusions are based on experience from similar areas. In the same manner, potential problems will be indicated and proper recommendations will be made.

(a) Climate

Climate, particularly precipitation, determines many limitations to tropical fruit

production in the project area. Analysis of climatic information from the area indicates that temperature, relative humidity and evaporation vary little during the year, whereas precipitation has considerable variation. Precipitation is higher than 150 mm in 6 months, from December to May and lowest value occurs in September. During dry season values are greater than 75 mm. Precipitation totals and distribution patterns vary greatly from year to year. Water balance for Itacoatiars shows that there are 7 months of excess water, indicating a potential drainage problem. Months with moisture deficit fluctuates from 1 to 5 months. The results of the analysis indicates that the main problems related to climate in the project area are:

- High temperatures do not allow the use of some valuable crops.
- There are 4 to 5 months of low rainfall, which will affect yields of some permanent crops, like bananas that requiere precipitation of 150-180 mm per month for optimal yieds.
- Relative Humidity is high, which will cause low evapotranspiration and create a good environment for pests and diseases.
- There are 4 months with precipitation higher than 150 mm/month, indicating a potential drainage problem.
- The months with high precipitation and consequently with no water stress have low potential evapotranspiration and therefore crops cannot reach their potential.
- High amount of rainfall and the length of rainy season shorten the effective working days.
- Road construction and maintenance is affected by high precipitation.

High precipitation during the rainy season not only could affects crop production by generating drainage problems, it also could affects crop management. Some of these affects could be: pesticides washed out, fertilizers are lost by leaching, drop of flowers and small fruits, damage to leaves. This is could be the reason why farmers are using greenhouse type plots in the Iranduba area.

(b) Soils and soil erosion

Soils: In the study area the most important soils are: “Latossolo Amarelo” (oxisols), “Laterita Hidromorfica” (ultisols) and “Gley Pouco Humico” (entisol). The most abundant soils are the Oxisols of Terra Firme. These soils have in common the low fertility levels, high Aluminum content and high acidity. This characteristic indicates the need for fertilization and amendments to obtain good yields. The lack of information for Itacoatiara, and the State make it difficult to access the real need for soil management., therefore research is needed to have reliable data.

Soil erosion potential: Forest soils of the amazon, as was stated before, are poor in nutrients but farmers do use fertilization, instead they use the slash and burn practice or shifting cultivation to compensate the loss of soil nutrients. To obtain a reasonable

income, farmers have to use more land than needed in normal situation, about four times more land. Terra firme soils, in the Itacoatiara area, due to its high content of clay, have low erosion potential but relief is undulated and usually with moderately high slope gradients. Precipitation intensities are very high and, as a consequence, soil erosion can be very high. Annex 5.5.3-1 shows 24-hour precipitation values for Itacoatiara. This data shows that, during the 1990-99 period, there was a high of 211.9 mm recorded in 24 hours and a minimum of 90.8 mm. When deforestation occurs, the soil surface is subject to runoff from rainfall and therefore the hazard of soil erosion increases.

Farmers, for several reasons, do not use soil erosion control practices. On the other hand, to avoid excess water problems, there is a tendency for planting on slope which increases soil erosion hazard. Under rain forest conditions, erosion potential is about 25 ton/ha/year, which is high. When land is under row crop use, the erosion potential increases to 164 ton/ha/year, this is more than six times the value under forest. The fact that farmers clear more land than is necessary makes the situation worse.

The above reasons indicate that it is necessary to give technical assistance to farmers to use soil conservation practices to reduce soil loss through erosion. Productivity can be increased by applying the proper inputs on a minimal amount of land, as opposed to increasing productivity through deforestation and crop expansion activities.

(c) Topography, relief and river dynamics.

Topography, relief and river dynamics determines the Terra Firme and Varzea landscapes. Except for some palm trees, like Açai, varzea area is not suited for other permanent fruit crops like banana, cupuaçu and maracujá. This implies that banana, Maracujá and cupuaçú have to planted in Terra Firme lands, where soils are less fertile than those of Varzeas.

The dynamics of rivers in the area do not allow permanent road and housing construction in the Varzea area and when river is at low level vessels cannot come close to some areas. There are not river levels records for Itacoatiara but farmers pointed it out in the Workshops. Unfortunately there is no available information to evaluate the extent of the flooded areas to determine the feasibility of construction flooding control infrastructure.

(d) Crop management

Considering the reviewed information, the RRA report, the workshop with farmers, visit to communities and information from IDAM technicians it can be concluded that farmers use very little inputs and do not perform basic crop management practices such as weed control, pest and disease control and drainage. In the case of Cupuaçu, for instance, plantations are getting old and farmers do not treat them for

witches broom disease or do not replace old trees. Farmers prefer to leave land in fallow for three years in stead of applying fertilizers. They argue that input costs are high and prices low and for that reason it is not worthwhile to spend money in crop production. In the next session this will be covered in more detail.

(e) Agroforestry

Agroforesty is being proposed by IDAM as an alternative for land use to protect the environment and improving farmers income. It is in an experimental phase and Itacaoatiara is one of the selected areas. The practice involves the utilization of several mixed crops like cupuaçu, açai, coffee, annual crops and high value forest trees like mahogany.

(f) Technical assistance

Technical assistance is provided by IDAM through its Technical Assistance and Rural Extension Program, ATER. The reduced personnel, isolation of communities and poor transportation facilities does not permit IDAM to give adequate technical assistance to farmers. At the same time, personnel is not well trained to cover all of the technical aspects required. Map A7.1 presents the distribution of communities assisted by IDAM where it is easy to observe scattering of the settlements and access difficulties.

(3) Summary of Production Constraints

There are many constraints which are obstacles to production of the four target fruits in Itacoatiara. These constraints are basically results of the previously described, existing conditions currently facing fruit farmers in Itacoatiara. These constraints are summarized for each crop, and for agroforestry, in Table 5.5.3-4.

(4) Processing and Distribution

(a) General Aspects

This section of the report will discuss some of the general aspects of processing and distribution that affect fruit farmers in Itacoatiara. After the general aspects are discussed, a more focused discussion of the existing conditions in the three Itacoatiara communities visited by the RRAQS team will follow.

(b) Processing

i) The Processing of Cupuaçu, Açaí, Maracujá, and Banana

The processing of cupuaçu, açaí, and maracujá are of significant economic potential to the State of Amazonas, especially in the case of cupuaçu as it produces more cupuaçu fruit and pulp that any other State in Brazil. Table 5.5.3-5 indicates the relative importance of frozen pulp production in Itacoatiara to overall levels in the State.

Table 5.5.3-4 Summary of Constraints Affecting the Productivity of Tropical Fruits and Agroforestry in Itacoatiara

Productivity	Crop, Soil and Water Management	Remarks
CUPUAÇU		
Productivity is less than the potential for the area. There is no sufficient data to compare with other States. This is the crop with better competitive possibilities	Witches Broom disease is a major problem in the area but farmers do not control it for economical reasons, therefore plantations are been abandon to minimum investments. EMBRAPA is selecting resistant clones but it will take several years to replace all plantations. There is a need for establishing nurseries for seedlings production and distribution. Crop is planted in Terra Firme Land where soils are Oxisols with low fertility, high aluminum content and low pH. Farmers use little inputs for the crop, due to marketing problems. Insufficient data does not permit to analyze crop zoning for the area. Variability of precipitation with 7 month excess precipitation and some water stress in dry months determines erratic harvest duration and schedule which determines farmers uncertainties in terms of harvest initiation, duration and expected productivity. It is necessary to evaluate the possibility of using simple drainage techniques, such as bedding. Plantations establishment is costly and requires financing.	Data availability is a problem for assessing problems and solutions in the area. There is a need for studying crop management problems and search for solutions.
BANANA		
Productivity is low as compared with other States. Production is small in the area. Para and Maranhão, neighbor States have higher production. The area have specific demands, plantains for instance that are provided from other states.	Black Sigatoga disease has devastated most crop areas in the State, Moko disease is also a problem. Resistant Hybrid seedlings have been introduced but there are problem with product acceptance and there is a need for establishing nurseries for seedlings production and distribution. Crop is planted in Terra Firme Land where soils are Oxisols with low fertility, high aluminum content and low pH. Farmers use little inputs for the crop. Insufficient data does not permit to analyze crop zoning for the area. Variability of precipitation with 7 month excess precipitation and some water stress in dry months determines seasonal production unless water management is used. Production in varzea areas is very risky and subject to flooding. Simple drainage practices like bedding should be studied to evaluate its feasibility.	Data availability is a limitation for assessing problems and solutions in the area. Yield units (bunches) utilized in crop statistics does not allow to evaluate ton yields for better comparison with other areas.
MARACUJA		
Productivity is low as compared with other States. Production is small in the area. Pará State has a much higher productivity.	Crop is planted in Terra Firme Land where soils are Oxisols with low fertility, high aluminum content and low pH. Farmers use little inputs for the crop. Insufficient data does not permit to analyze crop zoning for the area. Variability of precipitation with 7 month excess precipitation and some water stress in dry months determines seasonal production unless water management is used. Irrigation and drainage needs should be evaluated to determine its feasibility. IDAM is indirectly promoting irrigation, but there is not sufficient data to evaluate it. Simple drainage practiced like bedding should be evaluated to determine its feasibility.	Data availability is limitation for assessing problems and solutions in the area.
AÇAI		
Relatively ew crop in the area. There is insufficient data to evaluate productivity in the area	Being a new crop in the area, there is not local experience of production and problems. Açai could be planted in the varzea land providing there is not stagnated waters and that dry season is not severe. This crop grows well in Para where climatic condition are more adequate than in Amazonas. There is insufficient data to evaluate crop n the area. There is a need for identifying best areas for the crop and to evaluate practices to be used in the area. Promotion and technical assistance is necessary for the development of he crop. It is necessary to establish nurseries for seedlings production and distribution.	Data availability is a limitation for assessing problems and solutions in the area.
AGROFORESTRY		
New in the area and in experimental phase.	Systems are planted in Terra Firme Land where soils are Oxisols with low fertility, high aluminum content and low pH.. Variability of precipitation with 7 month excess precipitation and some water stress in dry months determines erratic harvest duration and schedule which determines farmers uncertainties in terms of harvest initiation, duration and expected productivity. It is necessary to evaluate the possibility of using simple drainage techniques, such as bedding.	Agroforestry is in experimental phase.

Table 5.5.3-5 Production Potential for Frozen Fruit Pulp Production in Itacoatiara and Amazonas State Based on 1999 Data

Pulp Type	1999 Amazonas Production (tons)	Amazonas Production Potential (tons)	Itacoatiara Production Potential (tons)	Itacoatiara Production Potential (% Amazonas)
Cupuaçu	663	7,506	2,508	33
Açaí	80	1,302	N/A	N/A
Maracujá	916	1,950	225	12
Pineapple	N/A	2,354	1,300	55

Source: IDAM Trimester Tables & Agroindustry Project Report, 1999

According to IDAM, these potential levels of pulp production can be obtained only if basic processing infrastructure in Amazonas is improved. IDAM suggests that 11 small pulp producing be built in the vicinity of Manaus over the next two years – two of these plants would be based in Itacoatiara. Should processing infrastructure improve, Itacoatiara would play a primary role in cupuaçu and pineapple pulp production.

In general, the Itacoatiara area suffers from extremely high post harvest losses of fruits and processed fruit pulps. The problem is principally due to poor commercialization. When the fruits are ready for market and the pulps have been processed, the farmer has a great deal of difficulty finding a buyer. Contractual arrangements are practically nonexistent, so the farmer has to transport the products to an area of commercial activity and hope to find a buyer. Due to poor farm to market feeder roads, and farmers living in areas isolated by rivers, the transport becomes very difficult and time consuming. Many of the small farmers in the Itacoatiara villages must link up with public passenger transportation in order to sell their goods in town. If this becomes too frustrating, the farmers will simply forego the journey and sell to brokers along the way.

The simple processing of tropical fruit into frozen pulps can significantly change the income earning ability of the typical fruit farmer in Itacoatiara. Table 5.5.3-6 illustrates the multiplication factors involved in the conversion of farmgate prices to retail prices currently attainable in Manaus.

Table 5.5.3-6 Indicative Prices (July 2000) for Fruit Products at Farm vs. Supermarket

	Farm Gate Price (R$/kg)	Supermarket Price (R$/kg)	% Price Mark Up
Cupuaçu Fruit	0.5	1.9	280
Cupuaçu Pulp	1.5	10.4	593
Maracujá Fruit	0.5	1.3	160
Maracujá Pulp	1.0	8.9	790
Açaí Fruit	0.3	1.1	267
Açaí Pulp	1.6	10.4	550

Source: Personal communication with farmers in Maués/Itacoatiara, DB Supermarkets

Generally, whole fruit directly marketed to supermarkets results in price increases in the range of 130-280 %, and frozen pulp products are marked up in the range of 550 - 790 %. However, for the small farmer to be able to realize

some of the potential profit in fruit marketing, there are tremendous obstacles for him to overcome, such as 1) access to financing for planting and processing operations, 2) lack of technology transfer, 3) maintenance of product quality and safety, 3) reliable transport, and 4) ease of sale.

The section will briefly describe some of the processing techniques currently being used by fruit-based agroindustries in the JICA Study area, as well as a few that are not being used but which have considerable potential. The typical processing operations for cupuaçu, açaí, and maracujá are similar enough that for the most part, they can be treated as a group. The processing of banana will be left out of the discussion since it is not significant in Itacoatiara or even the area of greater Manaus.

ii) The Processing of Frozen Fruit Pulp

Frozen fruit pulp is the most popular and most economically viable product that can be processed from these fruits. Although there are different levels of sophistication, the basic operations used by local pulp processors are described below:

- Reception:

Whole fruits arrive at the processing facility, are weighed, evaluated and sorted according to quality (maturity, sugar level, color). Ideally, these fruits should be received within 12-24 hours after harvest.

- Pre-Washing:

This is the first washing to remove large pieces of dirt and other contaminants adhering to the skin. It should take place in large tanks lined with stainless steel or ceramic tiles. Clean, running water should be used.

- Selection:

Fruits are sorted according to their level of maturity and state of physical integrity. Damaged or rotten parts of generally good fruit should be removed. Overly ripe or overly damaged fruit should be discarded. Immature fruit should be put in an environment, which accelerates the ripening process.

- Primary Washing:

Selected fruits should be rinsed in a new tank containing chlorinated water (10 ppm).

- Secondary Washing:

Final washing should tank place in another tank containing a weaker chlorine concentration (0.5-ppm).

- Removal of Skin (Husk):

This operation can differ quite a bit depending on the toughness of the outer layer of the fruit. With softer fruits like maracujá, the outer layers are removed using knives. In the case of cupuaçu, the husk must be split open and stripped away by manual force.

- Depulping:

This is the separation of the pulp from unwanted inner fibrous materials, seeds, and shell. In the case of cupuaçu, many simple processors use manual laborers who use scissors to extract the pulp. More sophisticated operations use a wide variety of mechanical depulping machines, which essentially use a combination of moving screens (0.5-0.8 mm) and mechanical pressure to separate pulp from seeds and fiber.

- Refinement:

If desired, the pulp is passed once through a finer screen (0.3 mm) to remove any remaining impurities and to give the final product a more homogenized appearance.

- Pasteurization/Pre-Heating:

For those few processors involved in exportation of product, pasteurization equipment is necessary to eliminate microbes in the product. Generally, a regimen of 100 deg C for 15 minutes is used. Pasteurization is said to remove much of the natural flavor of the pulp and therefore pasteurized product is often difficult to sell in local Brazilian markets. An intermediate treatment (preheating) can be used where the product is heated in a hot water bath at 80-85 deg C for only 5 minutes. This treatment provides some level of microbial control without significantly affecting flavor.

- Packaging:

Prior to freezing, the pulp should be put into bulk plastic containers anywhere from 10 –25 liters in capacity, or into 1 kg double-sealed non-corrosive steel cans. If dosage machinery is available, the pulp can be immediately measured and put into small, transparent plastic sacks in the range of 100 – 1000 gr for immediate marketing purposes. It is very important that the packaging material should not affect the flavor of the product during storage.

- Refrigeration:

Once packaged, the pulp should be frozen immediately, although often it is put under simple refrigeration (0-5 deg C) for a number of hours until transport to a freezing facility are completed. During this refrigerated transport, much

microbial multiplication can take place.

- Freezing:

The pulp should be frozen as soon as possible after extraction and pre-heating. For high quality product, ideally, instantaneous freezing using liquid nitrogen (-99.6 deg C) can be used to provide the best preservation of flavor. More typically, the pulp is frozen using commonly available freezers set -5 deg C.

- Storage:

Frozen pulp can be satisfactorily stored for up to one year. The ideal temperature for storage is –18 deg C. Product stored at warmer temperatures may only retain quality for 4-6 months. The pulp can be unfrozen at any time for the immediate preparation of juice or the incorporation into pastries or ice cream.

iii) The Processing of Fruit Preserves

Another popular products in the Amazon are preserves made from fruits such as cupuaçu, açaí, and maracujá. The following processing techniques are used:

- Formulation:

After the fruit pulp has been obtained, water and sugar are added to create a thick juice with a solids concentration of approximately 65%.

- Cooking:

The concentrated juice is brought to a slow boil after several hours until the point of "gel" formation is reached.

- Conditioning:

The gel is placed in glass jars and cooled in a water bath at about 87 deg C for 30- 50 min.

- Sealing:

The jars are hermetically sealed using automatic closure apparatus or simple homemade closures with rubber gaskets.

iv) The Processing of "Cupulate" (Cupuaçu-based Chocolate)

The cupuaçu plant is a relative of the cacao plant from which chocolate is derived. The seeds of the two plants are both high in fat content allowing for fermentation and processing into chocolate. There is increasing interest in other countries to process chocolate from cupuaçu and market it as an exotic variant of chocolate. The cupuaçu-based product is known as "Cupulate". Also, there is already an established market for locally manufactured candies from Cupulate in Manaus. These candies can be easily found in most

restaurants, small grocery stores and even supermarkets. Since producers of cupuaçu pulp normally throw away the seeds, Cupulate processing enables further utilization of the fruit. Despite the widespread depulping of cupuaçu in Amazonas, Cupulate processors have significant difficulty in finding reliable sources of seeds. The following steps are used to process Cupulate:

- Fermentation:

After being separated from the pulp and washed, the seeds are fermented in wooden boxes at 30-35 deg C for 4-6 days until a moisture level of 12% is reached

- Drying/Roasting:

After fermentation, the seeds are dried in the sun for 3-5 days (until a moisture level of 8% is reached) and then roasted in steel pans over an open fire or in special ovens.

- Milling/Molding:

After roasting, the shells are removed from the seeds either manually or mechanically. Next, the dehusked seeds are ground in a common mill (similar to that used for guaraná bars) resulting in a "massa" that can be molded into bars of various sizes. These bars are then cured in special conditioning rooms at 20-25 deg C where they lose moisture and assume the consistency of hard chocolate.

- Packaging/Storage:

These bars can be modified in size, wrapped in cellophane or tin foil, and immediately sold as homemade Cupulate candy. The bars can also be further processed into finer chocolate type products through the addition of ingredients such as cocoa butter, cocoa powder, and stabilizers.

- Other Uses of Cupuaçu Seeds:

After fermentation, the high vegetable fat component of cupuaçu seeds can be extracted and further processed into skin creams, which are currently being marketed in Manaus. Also, the shells of the cupuaçu seed and the shells of the fruit are high in nitrogen and phosphorus, and after thorough pulverization are quite suitable to be used as organic fertilizer or as a component of animal rations.

v) The Processing of Açaí "Vinho" and Dehydrated Açaí Powder

An extremely popular product in Amazonia is "vinho de açaí", or simply, fresh açaí juice. The dark colored, reddish-purple juice is squeezed from freshly obtained açaí pulp and is reputed to be highly nutritious and energizing.

However, this juice is highly perishable. As a remedy, several research institutions have succeeded in developing the technology for dehydrating the vinho and producing an "instant açaí powder". The basic processing steps are as follows:

- Maceration
- Depulping
- Centrifugation
- Spray Drying
- Packaging

The final dried product is vacuum packed into aluminized plastic pouches for sale to the consumer. The product has a shelf life of 3-4 months.

ASCOPE Case Study: Small-Scale Fruit Processing in Itacoatiara

Described below in detail is a fruit processing operation in Itacoatiara, which is run by one of the most successful small-scale farming cooperatives in Amazonas State. ASCOPE is highly regarded by IDAM as one of the best cooperatives in the State in terms of organization, entrepreneurial spirit, and highly motivated members. It is located in the vicinity of Novo Remanso and requires a 90-minute journey (by car and boat) from Itacoatiara town.

ASCOPE is an experienced, well-organized farming cooperative in Itacoatiara with a membership of about 80 farm families. Most of the coop members plant cassava and sugarcane as staple crops, and cupuaçu and pineapple as cash crops. Typically, a family has a 10 ha piece of land with 5 ha planted to cupuaçu and 2 ha to pineapple. ASCOPE has the following assets, which are unusual for most rural coops in Itacoatiara:

a. A floating store/restaurant on the river that provides goods and services to coop members at discount prices.
b. An all-purpose boat which can ship crop to Manaus and which can deliver farm supplies (and ice) from Manaus to the members.
c. A floating fruit processing plant which is run by the members and which has market connections in Manaus.

The coop was established in 1994 and although it got some startup funds from the FNO ("Fundo Nacional do Norte"), largely it has flourished due to good leadership and the strong entrepreneurial nature of its members. The processing plant operations are very simple. Fruit is received from the member farmers, washed, and sorted. Pulp is removed by a combination of manual operations and a small depulping machine (loaned to them by a government project). The fresh pulp is then put into plastic buckets and placed in large styrofoam-lined crates packed with ice. The crates or "cooling boxes" are then shipped to Manaus on the coop boat and delivered to the

customer. The boat ride can takes 24-48 hours.

The operation has the capacity to produce 2-3 tons of pulp per day, but in a typical harvest season ASCOPE produces a total of only 100-150 tons. Depending on the time of year and the quality of the crop, ASCOPE is paid 1.0 – 2.5 R$/kg for the pulp, landed in Manaus. Currently, they sell on a contract basis to just one client, the CIALI Food Processing Company. The price being paid by CIALI at the time of this study was 1.3 R$/kg. Typically, the coop pays its member 0.9 R$/kg for the raw pulp and the difference of 0.4 R$/kg is profit for the coop to use as it pleases (operating expenses for the boat, floating supply store, dividends to members, etc.). So, based on a crop of 100 tons of processed pulp, the coop would have revenues of approximately R$ 40,000 per season. ASCOPE wishes to expand and improve its business. CIALI has made an informal contract to purchase up to 300 tons of cupuaçu from them in 2000. The major constraints to their expansion are as follows:

a. Need for a more diversified market

Currently only markets one type of fruit to one client. Need more clients and the ability to process other fruits. They need technical assistance, help in establishing a business plan, and help in performing local market studies.

b. Sanitation

Although it has produced revenue for several years, the small processing plant suffers from several significant food safety problems. The processing conditions are very unsanitary, mainly due to the use of improper surfaces and containers for handling the fruits and pulp. The different operations (reception, washing, depulping, refrigeration) are not adequately isolated from each other. The facility should also strive to freeze the product before shipping. The current method of shipping pulp in wood crates packed with ice allows too much chance for microbial growth.

c. Need to upgrade production capacity

The current depulping machine is on loan, often breaks down, and is low capacity. They really need a new land-based facility with plastic or stainless steel working surfaces, a new depulping machine, a freezing tunnel or conventional freezers, and more space for each processing operation. Also, a well should be dug so fresh ground water can be used in the production process instead of river water. A properly equipped facility would cost about R$ 200,000 – their current facility probably represents an investment of R$ 20,000 only.

vi) Distribution & Marketing Aspects

- Post Harvest Distribution (Cupuaçu, Açaí, Maracujá)

The post harvest distribution chain that will be described below is based on EMBRAPA research for cupuaçu. The chain for açaí and maracujá is thought to be very similar, so the three fruits will be considered as a group. The distribution of harvested banana has some significant differences and is therefore treated in a separate section. Post harvest distribution will be discussed in terms of four basic components: (a) producers, (b) intermediaries, (c) retailers, and (d) final consumer.

Producers:

According to EMBRAPA, there are three categories of producers for these kinds of fruits:

Type I Producer

- Simple and traditional, using mostly hand labor provided by family members without any cash reimbursement.
- Generally no access to rural credit, therefore, any use of inputs such as fertilizer and pesticides.
- Plants these fruits in association with other forest species and occasionally with annual crops.
- Generally harvests once per week and brings the crop directly to local open markets without adding any value to the crop. Sometimes will sell to Type I agroindustries.

Type II Producer

- Farm labor is largely family-based with some contracted workers.
- Usually has some access to technical assistance and rural credit.
- Will use some fertilizer and pest control if cash is available.
- Typically has simple depulping equipment and an access to a freezer.
- Plantings are generally mixed with other forest species and some annual crops – occasionally monoculture of one fruit is practiced.
- Will add some value to the crop by employing simple depulping operations (manual or mechanical) and selling the pulp to Type III producers or to some intermediaries and small agroindustries.

Type III Producer/Processor

- Produces fruits, buys fruits from third parties, and processes limited amounts of pulp with simple equipment (depulper, freezer, dosage machine for packaging).
- Has access to technical assistance and rural credit. Uses fertilizers, pesticides, approved cultural practices (such as pruning) and improved varieties.

- Sells packaged, recessed pulp to Type I and II agroindustries and intermediaries, and sometimes directly to the consumer.

Agroindustries:

There are two categories of agroindustry involved in processing these fruits, mainly distinguished by the level of attention to food safety and product appearance:

Type I Agroindustry

- Buys fruits from Type I and II producers and uses mechanical depulping.
- Packages, freezes, and sells pulp to Type II agroindustries or directly to the final consumer (snack bars, hotels, restaurants, bars). Pulp is generally transformed into juice or desserts such as puddings and frozen cream snacks.
- Control of hygiene is minimal and packaging materials can often be of low quality.

Type II Agroindustry

- Buys pulp from Type II and III producers and Type I agroindustries, further adding value to the fruit through the processing of candies, frozen cakes, licors, cookies, and ice cream products.
- Serious efforts are made to control hygiene problems and some level of quality is evident in the packaging and labeling of the products.
- The candies are usually commercialized through restaurants, hotels, and shops, which specialize in regional products.
- Some sales are made to Type II retailers and directly to the final consumer if the quality is good enough.

Farmers make direct sales of the fruit to the consumer, intermediaries, and open markets. Often, sales to the open market stalls are under consignment – therefore, any unsold product is returned to the producer. During peak harvest season, it is very difficult for the producers to sell all of their harvest, even though the fruits are at very low prices compared to other times of the year. This is especially the case with cupuaçu farmers in Itacoatiara. Although there is plenty of demand in the urban areas, the farmers are not well organized and are poorly connected to the sources of demand. As a result, much of the fruit is brought to market and never sold. Often farmers refuse to dump their fruit at absurdly low prices, preferring to return it to the farm as feed for livestock or cultured fish.

Intermediaries/Retailers:

Generally, two types of intermediaries and retailers are recognized in the distribution chain:

Type I Intermediary

- Generally buys fruits of high quality from Type I and II producers either at their farms or through contact at the open markets in the interior municipalities. The fruit is then brought to Manaus where it is resold to Type II intermediaries, Type I retailers, or Type I agroindustries.

Type II Intermediary

- Buys fruits and pulp from Type 2 and 3 producers and from Type I intermediaries. - Usually equipped with mechanical depulper, freezers, and walk-in cold rooms. Sells pulp to Type II retailers or to final consumers (ice cream producers, fast food restaurants).

Retailers:

Type I Retailer

- Operates primarily from the larger opens markets (such as Panair, Manaus Moderno) and commercializes fruits bought from Type I and II producers and intermediaries. Some will buy pulp from Type I agroindustries and sell it in bulk plastic bags (1-5 kg) without any distinct labeling. Other more sophisticated retailers will employ very distinct, fancy packaging techniques to ensure sales potential in the higher end local supermarkets and in export markets.

Type II Retailer

- This is the formal "supermarket" sector, which buys both fruits and pulp from various suppliers. The fruits can be bought directly at farm level from Type I and II producers, but more commonly they are bought from intermediaries who bring the fruit directly to the supermarket.

  Some supermarkets possess their own processing infrastructure such as depulping machines, dosage and packaging machines, and cold rooms. They process and market their own frozen pulp products to ensure that the consumer is getting a safe, unadulterated product. Generally, they will offer contracts to select, high quality suppliers. Most all the stores also sell prelabelled and packaged pulp from highly reputable Type I retailers such as "BrasFruit" and "Amazonia Polpas".

Final Consumer:

This sector is made up of the hotels, restaurants, ice cream manufacturers, fast food establishments, and those home consumers who buy their frozen pulp directly from Type I and II retailers. The hotel sector buys strictly frozen pulp for the manufacture of fresh juice for their guests. Some hotels also prepare desserts from the pulp. Ice cream companies buy the pulp for the flavoring of ice creams and for the sale of shakes and other drinks at their restaurant outlet stores.

vii) Post Harvest Distribution Chain (Banana)

The distribution chain for banana is significantly different from the other three fruits due to the following factors:

- Significant domination of the market by intermediaries. Intermediaries control the local, regional, and to some extent, the export markets.
- Due to the presence of many intermediaries, the traditional banana farmer has more choices as to where and when to sell the fruit vs. the cupuaçu or açaí farmer. But due to the strong position of the intermediaries, he has little chance to affect pricing and therefore make significant income.
- Due to lack of a pulp market, banana distribution is highly dependent on the open-air markets or 'ferias" - in fact, some of these "ferias" are designed almost exclusively for the marketing of bananas.
- Most all of the banana is consumed as fruit by the final consumer. There is very little processing activity.
- There is a significant need for upgrading banana receiving areas in the major towns and in Manaus. There are very limited areas for short term areas for storage and conditioning. Large refrigerated warehouse space is practically nonexistent in the Manaus area.

Three basic types of transactions take place in the post harvest distribution of bananas:

- The sale of green bananas, in large bunches in bulk, or in smaller bunches in boxes (less frequent).
- The sale of ripe banana in wholesale markets, in boxes or loose bunches (less frequent).
- Sale of ripe bananas in retail markets, in small bunches of one dozen fruits, or by weight (less frequent).

The typical banana farmer in Amazonas has many options for the sale of his fruit. He makes his final decision based on variables such as distance to the points of sale, production volume, and the local market requirements for green vs. ripe bananas. Unlike the farmers of cupuaçu, açaí, and maracujá, there are very few options for him that involves processing industries. If banana processing industries were to play a more important role in the distribution chain of Amazonas, the farmer would have yet another option for a point of sale. Also, all the wholesalers and retailers would also have an outlet to sell their lower classes of bruised banana, which is highly, damaged both at farm level and as a result of difficult transport conditions. Improved protection during transport, and the promotion of processing industries, could help to recover much of these post harvest losses (30-40%) in the banana distribution chain.

5.5.4 Wild-caught Fishes (Capture Fishery)

(1) Fish Production of the Amazonas State

According to the latest official statistics of the Federal Government, total fish catch of the State was 485,000 tons in 1997 (Annex 5.5.4-1), which correspond to 27% of total freshwater fishery production of the country or 7% of the total fishery production.

However, through the study, it was understood that none of fishery researchers who were interviewed trust the government's statistics as far as that of the Amazonas State is concerned. Therefore, fish production was estimated by using various production data that were collected during the study. Thus, total fish production of the State was estimated to be 66,200 tons in 2000 excluding subsistent fish catch of local people as shown in Table 5.5.4-1. When subsistent fish catch is included, it would be about 120,000 tons a year (Dr. Carlos Araujo-Lima of INPA, personal communication).

Table 5.5.4-1 Estimation of fish production of the Amazonas State

Available information			Estimation in this study as of 2000	
Subjects	Latest data available	Souce	Production	Assumptions/Remarlks
Fish landing at major fish landing places				
Manaus				
Adolfo Lisboa	21,065 ton in 1999	FEPESCA	21,000 ton	
Panair	23,541 ton in 1996	Batista (1998)	12,000 ton	After 1997, major fish landing site was shifted to Adolfo Lisboa.
Ceasa and others	n.a.		4,000 ton	
Manacapuru	414 ton in 1996	Batista (1998)	500 ton	
Parintins	570 ton in 1996	Batista (1998)	800 ton	920 ton in 1983 (Falabella, 1994)
Itacoatiara	1,641 ton in 1996	Batista (1998)	1,700 ton	
Iranduba	n.a.		500 ton	
Maués	664 ton in 1999	Colonia Z-16 (2000)	700 ton	
Tefe	1491 ton	Barthen (1999)	1,500 ton	
Coari	1,028 ton in 1983	Falabella (1994)	1,000 ton	
Bj. Constant/Tabatinga	2,121 ton in 1983	Falabella (1994)	2,000 ton	
Others	n.a.		10,000 ton	50 places x 200 tons
Fishes marketed through frigorifico				
Domestic export	5,643 ton in 2000	DFA-AM	9,000 ton	Processed amount is comverted to whole fishes
Aquaculture	1,255 ton in 1999	IDAM	1,500 ton	500 fish farms x 3 tons/fish farm
All fishes in the State	48,500 ton in 1997	DPA, MAA	66,200 ton	

Remarks: 1) Fish catch of subsistent fishermen and other local people for their consumption is not included.
2) Aquaculture production includes amount of self-consumption.

(2) Fishing Activities

(a) Outline

Fishes of the Amazonas state are mainly caught by professional fishermen who register the name and/or fishing vessels at Colonias or Associacoes (Fishermen's Organization, see Section 5.8.3) of each municipal. Their numbers including ship owners and crew are 23,494 in the State, but actual number would be about 45,000 (interview to FEPESCA/AM/RR). Large-scale ship owner often possesses several fishing vessels and does not join fishing operation, while small-scale owners go

fishing together with crew fishermen.

In addition to those professional fishermen, there are many local small-scale fishermen who operate motorized or non-motorized canoe and sell fishes to neighbors, local market and professional fishermen encountered. There are many local people, mostly small-scale farmers, who go fishing regularly for their own consumption.

Wide variety of fishing gear is used; from bow and arrow of subsistent fishermen to purse seine (redes de arrasto) of commercial fishermen. For small-scale fishermen that mean all the subsistent fishermen and a part of professional fishermen, gill net (malhadeira) is the most common fishing gear followed by cast net (tarrafa), hook-and-line (linha-de-mao), and fish trap (matapi).

(b) Composition of fish species

Recent fish unloading data and those in 1983 at the Adolfo Lisboa, the biggest fish landing place in Manaus, are shown in Table 5.5.4-2. In all the year, jaraqui is the dominant fish species unloaded in Manaus occupying 40-50% of total amount, followed by curimata, pacu, and matrincha. A total of those characiformes fish species reaches to be about 90%. Amount of catfishes unloaded to fresh fish markets is less than 5% since most of them are marketed directly to frozen-processing companies. Remaining portion of about 5% is shared by perciforms fishes like tucunare and osteogrossiformes namely aruana and pirarucu. These tendencies in species composition were more or less unchanged when compared to 1980s.

On the other hand, it shall be pointed out that percentage of some specific species was decreased obviously in recent years. Those are pirarucu and tambaqui (Table 5.5.4-2), mainly due to overexploitation.

Table 5.5.4-2 Compostion of fishes unloaded at the Adolfo Lisboa fish landing place, Manaus

Unit: tons

Species	1997	1998	1999	Average 1997-99	(%)	for comparison 1983	(%)
Osteogrossiformes							
Aruana	331	383	533	416	2%	352	1%
Pirarucu	0	0	0	0	0%	308	1%
Characiformes							
Jaraqui	8,653	7,540	9,853	8,682	45%	10,843	45%
Curimata	3,306	1,474	2,838	2,539	13%	2,491	10%
Pacu	2,482	1,557	1,903	1,981	10%	1,048	4%
Matrincha	2,406	343	1,997	1,582	8%	486	2%
Tambaqui	1,375	775	781	977	5%	4,268	18%
Sardinha	1,059	729	850	879	5%	635	3%
Pirapitinga	727	125	881	578	3%	359	1%
Branquinha	0	44	87	44	0%	659	3%
Perciformes							
Tucunare	722	493	453	556	3%	834	3%
Pescada	215	122	357	231	1%	412	2%
Aracu	195	122	178	165	1%	213	1%
Cara	105	118	198	140	1%	0	0%
Catfishes and others	374	413	158	315	2%	1,292	5%
Total	21,950	14,236	21,065	19,084	100%	24,201	100%

Source: FEPESCA/AM/RR (1997-99), Falabella (1994) for data of 1983.

(c) Major fishing ground

Large amount of fishes are caught from so-called white water particularly from the Amazonas-Solimoes main stream and Purus River. Fish catch from black water namely the Negro River contributes only 5-9% of the total (Table 5.5.4-3). It is common in the case of purse-seine vessels that one fishing trip last for more than one month.

Table 5.5.4-3. Fish unloaded at the Adolfo Lisboa fish landing place in Manaus by fishing ground.

Unit: tons

Fishing ground	1997		1998	
White water				
Amazonas - Solimoes main stream	7,768	*35%*	3,917	*28%*
Japura River	645	*3%*	271	*2%*
Jurua River	282	*1%*	238	*2%*
Purus River	9,074	*41%*	6,948	*49%*
Madeira River	1,906	*9%*	309	*2%*
Black water				
Negro River	1,189	*5%*	1,305	*9%*
Others (not specified)	1,085	*5%*	1,249	*9%*
Total	21,949	*100%*	14,236	*100%*

Remarks: Amazonas-Solimoes main stream include its branches of the Autazes, Mamia and Copea Rivers. The Purus and Madeira Rivers include their branches of the Tabpua River and the Canuma River, respectively.
Source: FEPESCA/AM/RR, Daily monitoring data.

(d) Fishing season

Figure 5.5.4-1 indicates monthly fluctuation of fish unloading at the Adorfo Lisboa Fish Landing Site, Manaus in 1999. There are two fishing seasons for jaraqui, one is from December to January when this species gathers for spawning migration, and the other is from May to June when young jaraqui make schooling in varzea. Matrincha shows a peak season around May. For many other species, major fishing season is extending from August to November when water level is low.

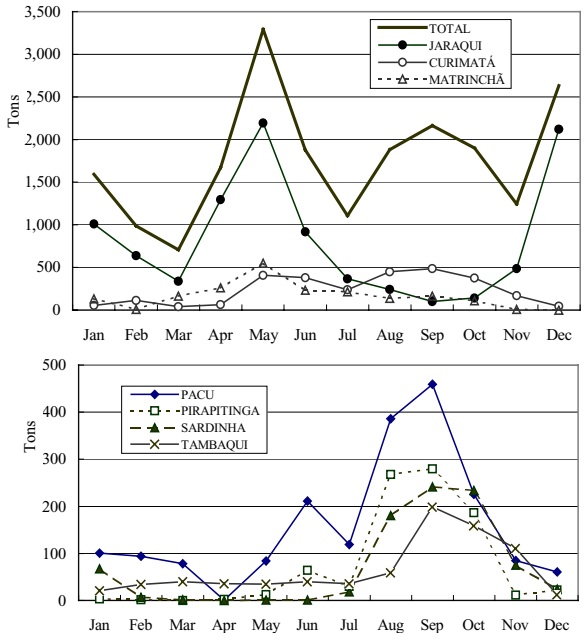


Figure 5.5.4-1 Monthly fluctuation of fish unloading at the Adorfo Lisboa Fish Landing Site, Manaus in 1999.

(3) Fish Processing

(a) Frozen-processing

There is a total of 11 major frigorificos in the State (Annex 5.5.4-2). Their recent production was 8,000-10,000 tons a year but it was droped sharply to be 5,643 tons in 2000 (Table 5.5.4-4 and Figure 5.5.4-2) due to stop of operation at the Friuba LTDA of Iranduba, which is the largest-scale frigorifico in the State.

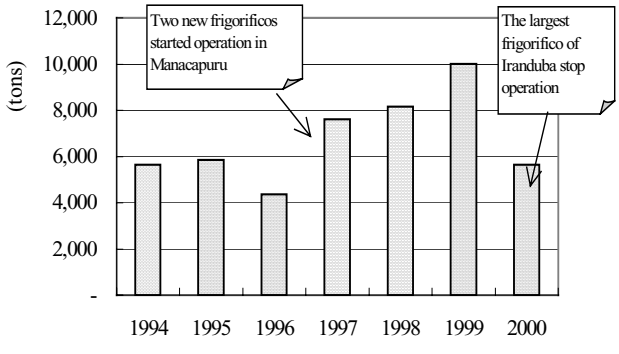
Table 5.5.4-4 Production and marketing amount of frozen fishes in/from Amazonas State (actual weight)

tons

	1999			2000		
	Production	Marketing amount		Production	Marketing amount	
		Outside State	Inside State		Outside State	Inside State
Osteogrossi formes						
Pirarucu	0	0	0	0	0	0.2
Aruanã	0	0	0	103	31	9
Sub-total	*0*	*0*	*0*	*103*	*31*	*9*
Characiformes						
Pacu	2	12	0	186	129	210
Ararú	3	0	0	107	65	56
Curimatã	99	22	0	101	106	101
Jaraqui	13	4	0	52	14	11
Sardinha	320	39	0	47	299	61
Pirapitinga	0	0	0	40	54	12
Tambaqui	18	7	0	5	5	0
Matrinchã	0	1	0	1	2	0
Others	0	5	0	35	40	52
Sub-total	*456*	*90*	*0*	*573*	*716*	*503*
Perciformes						
Tucunaré	483	43	0	150	427	115
Pescada	3	7	0	100	29	72
Cará-açú	8	0	0	12	3	9
Sub-total	*494*	*50*	*0*	*262*	*459*	*196*
Siluriformes						
Mapará	628	362	11	1,223	507	607
Dourado	1,632	1,282	89	778	721	412
Surubim	1,395	1,094	167	755	629	283
Piramutaba	4,244	2,673	575	741	823	308
Filhote	516	410	41	382	294	123
Pirarara	296	168	33	193	177	115
Babão Bandeira	15	3	0	173	88	93
Jaú	268	156	36	166	192	76
Barbado	33	24	0	78	25	0
Tamoatá	12	0	0	46	68	62
Others	15	0	0	145	130	9
Sub-total	*9,052*	*6,171*	*952*	*4,680*	*3,652*	*2,088*
Others	*0*	*0*	*0*	*24*	*0*	*1*
Total	*10,002*	*6,312*	*952*	*5,643*	*4,857*	*2,797*

Source: DFA-AM ReRemark: Total of production and total of marketing amount are not the same, because of the time gap.

Usually fishes are processed into four types of frozen-processed form namely "whole fishes", "without gut", "cut in pieces" and "fillet". Fishes of without gut, which are made mostly from catfishes (siluriformes fishes), are dominated in amount sharing 91.6% in 1998 followed by whole fishes (5.3%), fillet (2.8%) and cut in pieces (0.2%) (see, Annex 5.5.4-3).



Source: DFA-AM

Figure 5.5.4-2 Production of frigorificos in Amazonas State

Frozen fish products were mostly traded for outside the Amazonas State, namely supermarkets in the southern regions of the country i.e., São Paulo and Rio de

Janeiro, as well as the neibouring Para State and the Northeast Regions. Whereas, marketing amount of frozen fish inside the State tended to increase in recent years. It was increased to be 2,797 tons in 2000 from 952 tons in 1999 (Table 5.5.4-4). This indicates basically that people in Amozonas gradually accept frozen fishes or catfishes.

However, business of frigorificos seems to turn into difficult situation at present as seen in the aforementioned Friuba LTDA case. This is mainly due to recent decrease of fishery resources such as large-size catfishes (piramutaba, dorado and surubim) as well as pirarucu and tambaqui which have been known as overexploited species since late 1980s. Size of those species has been obviously getting smaller in recent years. Other reason is unefficiency of operation of facility. Reflecting the high peak of fishing season for the valuable species, full operation of factory can be realized only during several months of the year from September to January (Figure 5.5.4-3). Owners of *frigorificos* stated that although there was a strong demand of quality fishes in the country, it was difficult to meet the demand.

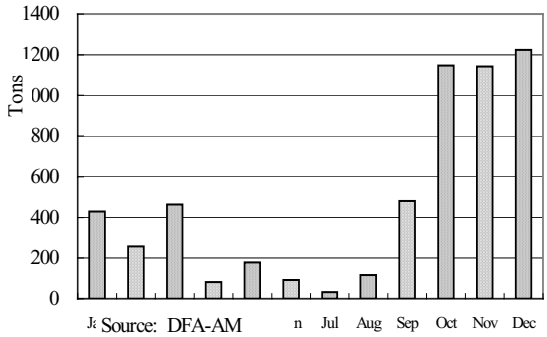


Figure 5.5.4-3 Monthly change of frozen fish production in Amazonas State (2000)

(b) Other fish processing

There are some other processing forms of fishes, but their quantity is very limited comparing to fresh fishes in the Amazonas State. Dried and salted fishes are popular in local communities but their commercially marketing amount is not much (no statistics is available). Salted-dried pirarucu called "*manta*" is known as traditional fish processing in this locality, but there is little production now due to prohibition of pirarucu fishing in the State. The other traditional fish processing, namely "*piracui*" that is known as fish *farinha* (fish flour) is also carried out by using fishes with low fat content such as acari. However, the center of *piracui* production is known as Santarem of the Para State, and the production of the Amazonas State is not pronounced.

Value-added fish processing such as can, surimi, fish ball or smoke has not been carried out intensively or in large-scale commercial bases, although those products are able to produce technically according to INPA-CPTA.

The aforementioned undeveloped state of fish processing is explained basically by preference of people in the Amazonas State towards fresh fishes. This is supported by ample abundance of fresh fishes (characiforms species) in the markets.

5.5.5 Cultured Fishes (Aquaculture)

(1) Aquaculture of the Amazonas State

(a) Number of fish farms and production

At present, exact number of fish farms and their production in the Amazonas State are difficult to specify because of unavailability of statistical data.

Based on the data compiled by the Planning Section of IDAM, it is recorded that there are 324 fish farms in 1999 producing 1,255 tons in total or 3.9 ton/farm in an average production (Table 5.5.5-1). Those data should be revised in near future considering proper definition of fish farms, since there is some inconsistency in data at municipal level

Table 5.5.5-1 Number of fish farm and aquaculture production in the Amazonas State

	No of farm	Production (ton)	Average (ton/farm/yr)
1996	258	1,045	4,1
1997	199	1,052	5,3
1998	227	1,207	5,3
1999	324	1,255	3,9

Source: IDAM Planning Secition

(b) Culture facilities

Most common facility used for fish culture in this locality is so-called barragem, which is a dam pond constructed on igarape (small water canal originated from spring water) (Figure 5.5.5-1). It shall be noted that the barragem requires natural spring as a source of water. In progressive farms, some earthen ponds are constructed in the downstream of barragem and electric puddle wheel is introduced for aeration.

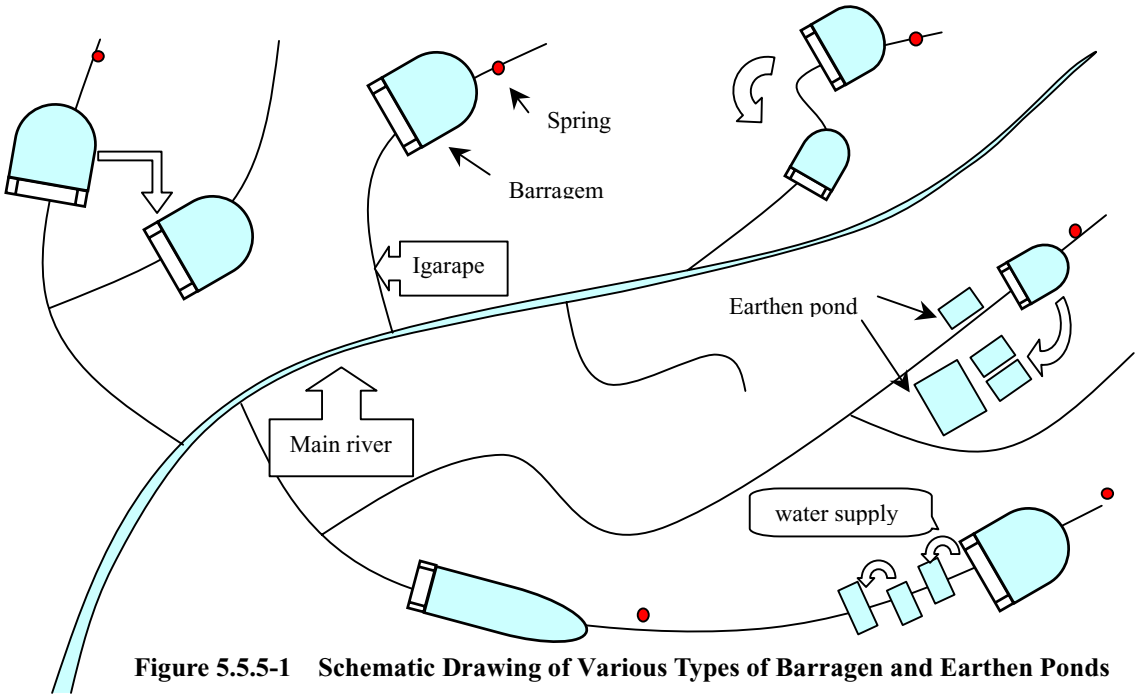


Figure 5.5.5-1 Schematic Drawing of Various Types of Barragen and Earthen Ponds

Distribution of fish farms by municipal indicates a mosaic pattern (Annex 5.5.5-1). This is due largely to distribution of igarape and available amount of natural spring.

Municipals having number of active fish farms such as Coari, Rio Preto Da Eva, Presidente Figueireito, Manaus and Manacapuru are geographically endowed with such water source.

(c) Fish fry

Artificial fish fry of tambaqui is now able to produce abundantly not only at the IDAM Balbina Hatchery (IBH) but also at several private hatcheries in the State. Apart from tambaqui, IBH is producing some curimata and matrincha fry. Fry of exogenous carp and tilapia is also produced in some private hatcheries, but this is not allowed in the Amazonas State because of possible disturbance to the ecosystem when the fry runs into natural environment. Fish fry other than those species are basically obtained by capture of catching of wild juveniles.

Most of fish farmers in Manaus and the vicinity is benefited by artificial fry of IBH, while those in municipals located at the margin of the State are said to procure the fry from neighboring other states or countries. For example, fish farmers in Itamarati and Envira are known to purchase the fry from hatchery of the Acre State, and those in Benjamin Constant and Tabatinga, from Leticia City, Colombia.

(d) Feed

Various types and size of artificial feed (dry pellets) are now commercially marketing with retail price between R$ 0.56 (protain content: 17%) - R$ 2.23 (protain content: 48% for juvenile surubim) per kg. Dry pellets of R$ 0.6-0.7/kg are commonly used for grow-out of tambaqui in medium-large scale fish farms of the Amazonas State.

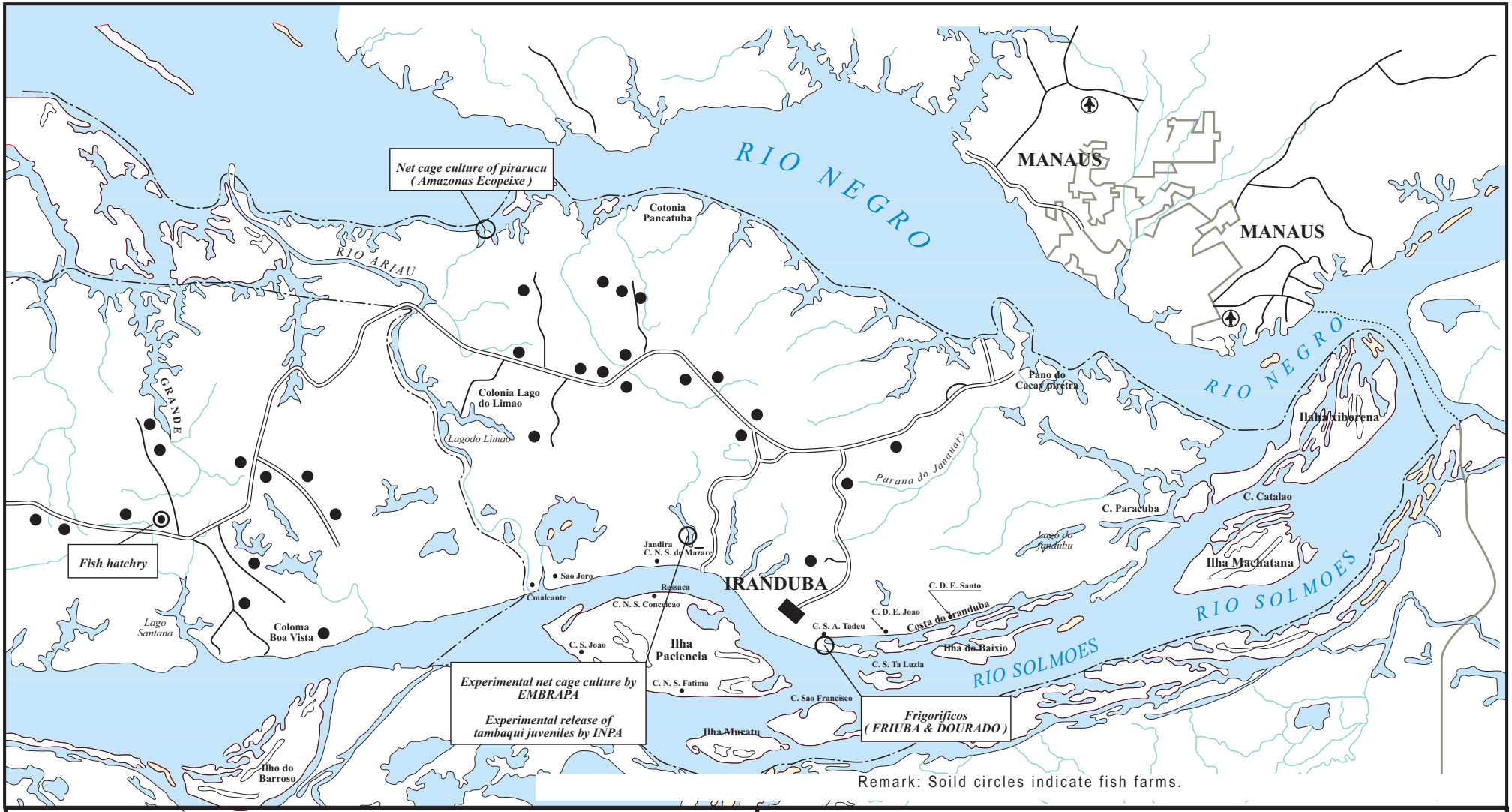
On the other hand, since the artificial feed is costly, small-scale farms often feed fishes on locally available raw materials such as residues of bread, beer and other food processing industry as well as natural fruit and seeds of plants.

(2) Aquaculture Activity of the Study Area

(a) Iranduba and the vicinity

There is a total of 17 and 24 farmers who have or are constructing fish culture facilities namely barragem and/or earthen pond in Iranduba and a neighboring municipal Manacapuru, respectively. Total area of existing fish culture facilities is estimated to be 33.7ha in Iranduba and 101.9 ha in Manacapuru. Those farms are all located in terra firme (Figure 5.5.5-2).

Most popular culture species is tambaqui followed by jaraqui, matrinchã and several other small species such as curimata, acara-acu, cara, tucunare, etc. Pirarucu is also reared in many farms, although there have been few cases that cultured pirarucu was shipped to market. Surubim is not cultured in this locality as well as in other municipalities of the State.



The Study for the Improving Rural People's Livelihood through Agricultural Activities and Sound Natural Resources Management in the State of Amazonas

Japan International Cooperation Agency (JICA)

Figure 5.5.5-2
Distribution of Fish Farmers and Relevant Facilities in Iranduba

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Number and area of fish farms in Iranduba and Manacapuru are examined by size category of facilities as shown in Figure 5.5.5-3. Among the total of 39 existing fish farms, 21 (54%) are very small-scale having a barragem 0.1 - 1.0 ha.

Cummulative area of those farms is as small as 14.9 ha or 11% of the total. On the other hand, there are 5 large-scale farms having facility more than 9 ha each. Their areas are extended to 63.7ha or 47% of the total. The wide variety of farm scale is one of the characteristics not only in this locality but also in all the Amazonas State.

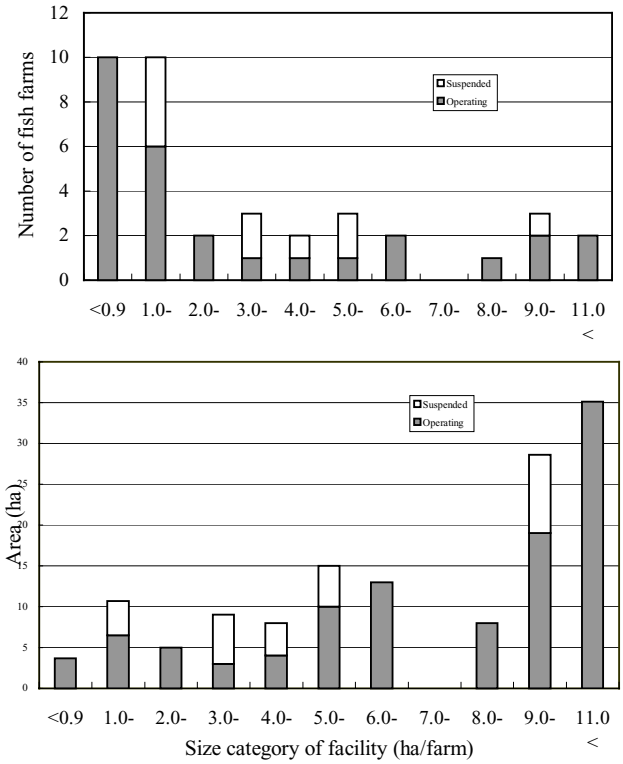

Figure 5.5.5-3 Number and area of fish farms by size cateory of facility in Iranduba-Manacapuru.

Source: IDAM Aquaculture and Fishery Section (2000)

At present, there are numbers of farms that suspend operation (Figure 5.5.5-3). There are various reasons such as unsatisfactory technical ability, shortage of budget, insufficient spring water volume, etc. Those abondan farms consist 26% in number and 21% in area. This is one of serious problems at present.

Apart from individual operators, there is an aquaculture entrepreneur namely Amazonas Ecopeixe LTDA which have started net cage culture of pirarucu at Asutuba that located along the Negro River since 1999. More information about the campany is given in Chapter VII.

(b) Itacoatiara

Several aquaculture farms were established in early 1990s along the main road connecting to Manaus. One of them located at km 197 was as large as 100 ha in total area with about 8 ha of water area (2 barragem and more than 15 earthen ponds), and had been operated as fishing-in-pay. However, it was bankrupted in 1997 probably due to wrong financial management. There are some other abandoned farms in the vicinity. At present, three aquaculture farms are confirmed to be in operation in Itacoatiara. One is Amazon Fish LTDA which has been producing not only grow-out fishes but also artificially produced fish fry. The second is a small-scale farm located around km 180. The third is Ecofish LTDA which started experimental net cage culture of tambaqui in Rio Urubu.

(c) Maues

At present there is no aquaculture activity observed in Maues, although local people particularly fishermen show strong interest on aquaculture.

(3) Processing of Cultured Fishes

Almost all cultured fishes are now marketed in fresh state. There is one local frigorifico in Manaus named Peixam LTDA processing cultured tambaqui into minced product (picadinho) and selling it in supermarkets. More detail description is given in Chapter VII.

(4) Required Licenses for Aquaculture

Licensing system of aquaculture had been confused, because of the change of administrative organization from IBAMA of MMA to DPA of MAA in 2000, and issuance of similar invoices from IBAMA, Federal Government and IPAAM, State Government.

Now, fish farmers are requested to possess the two licenses namely Aquaculture License issued by DPA of MAA, and Environmental Licenses issued by IPAAM. The former is for selling the cultured fishes and the latter is for construction and operation of fish farming facility. Fee tables and calculation rules are shown in Annex 5.5.5-2.

5.6 Marketing

5.6.1 Identification of Distribution System

The foodstuff currently traded in the state of Amazonas is categorized into three types, products consumed in the same state mostly in the same region, products from other states, and products exported to other states. Staple foods such as farinha (mandioca flour), fruits, fish are produced and consumed in the state, but there are imported foods such as rice, beans, flour and vegetables. Imported vegetables such as potato, onion, tomato come mostly from southern states through Porto Velho. Exporting items including frozen fish and guaraná are traded by specialized traders who often have processing and refrigerating facilities.

Based on these categories, three major marketing channels are identified, namely I) produced and consumed in the state of Amazonas, II) produced outside and imported to be consumed in the state of Amazonas, and III) produced in the state and exported to be consumed outside.

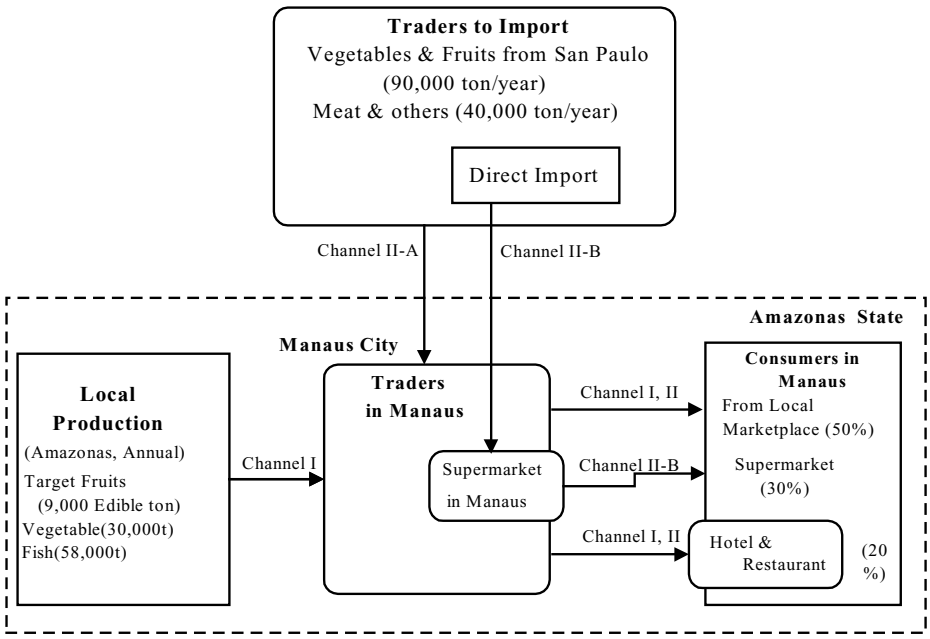

Figure 5.6.1-1 Marketing Channel I and II

Channel I produced and consumed inside the state of Amazonas is the major flow of commodities when we think about the sustainability of the development project. The amount of production of the 4 target fruits in the 3 schemes regions are estimated as 9,000 tons of edible portion. In the state of Amazonas, 120,000 tons of fruits as a whole, 30,000 tons of vegetables, and 58,000 tons of fish. Consumers of Manaus obtain these commodities via traders and retailers.

Import from outside the state include vegetables and fruits produced in the southern states, and are mostly transported by truck to Manaus.

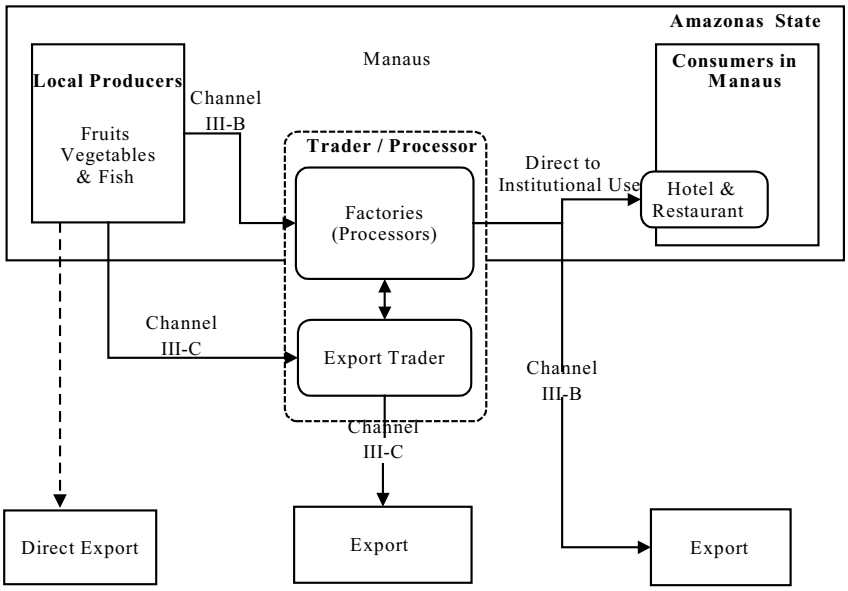

Figure 5.6.1-2 Marketing Channel III

Channel III refers to the export of commodities to outside of the state. Items to be exported is limited to certain value crop such as guaraná and fish. Guaraná is dried,

roasted and mostly ground to make it in the form of powder. There are some individual guaraná exporters but the majority is traded either by large capital exporters from outside or by manufacturers for further processing into drinks or concentrates. Fish to be exported is limited to catfish. After semi-processing of cutting head and tail, fish is frozen by local refrigerator and traded mainly to São Paulo.

5.6.2 Municipal Market in Manaus

There are more than 60 public marketplaces operating in the city of Manaus. Active markets with more than 100 registered traders are exhibited in the Figure 5.6.2-1. The largest market compound area is the Mercado Adolfo Lisboa, Feira Cel Jeorge Texeira and Feira Moderna constitute a large market zone by the river port. For the location please refer to Figure 5.6.2-2.

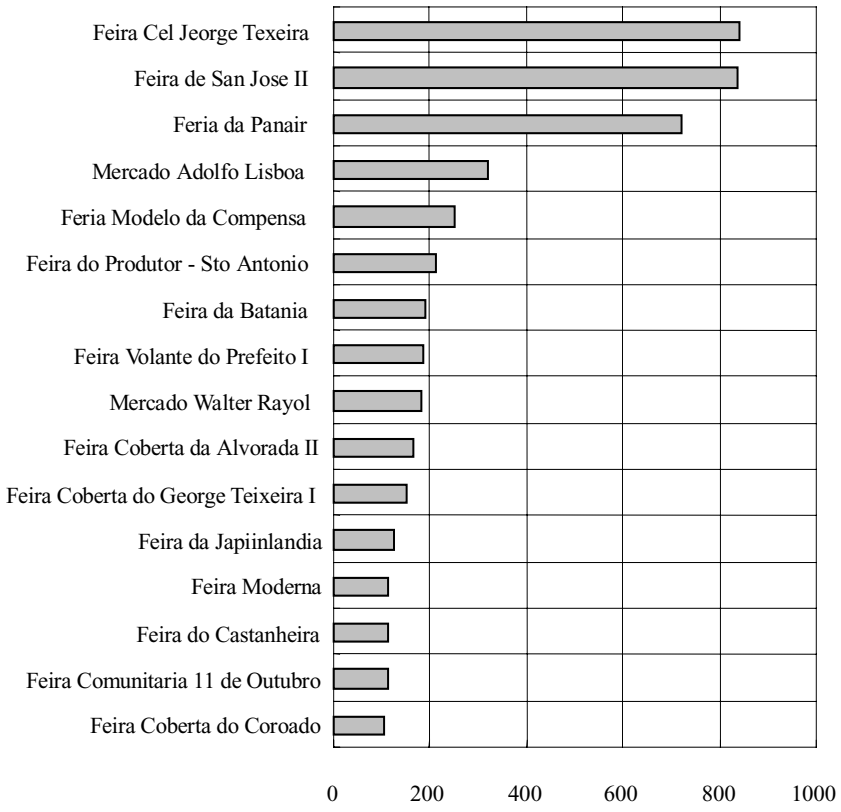

Figure 5.6.2-1 Major Marketplace by the Number of Traders

5.6.3 Marketing of Guaraná

Based on information obtained from the Ministry of Agriculture, small farmers, small processors, and the guaraná beverage sector, a general flow diagram (Figure 5.6.3-1) can be constructed which describes the overall distribution of guaraná from Maués municipality.

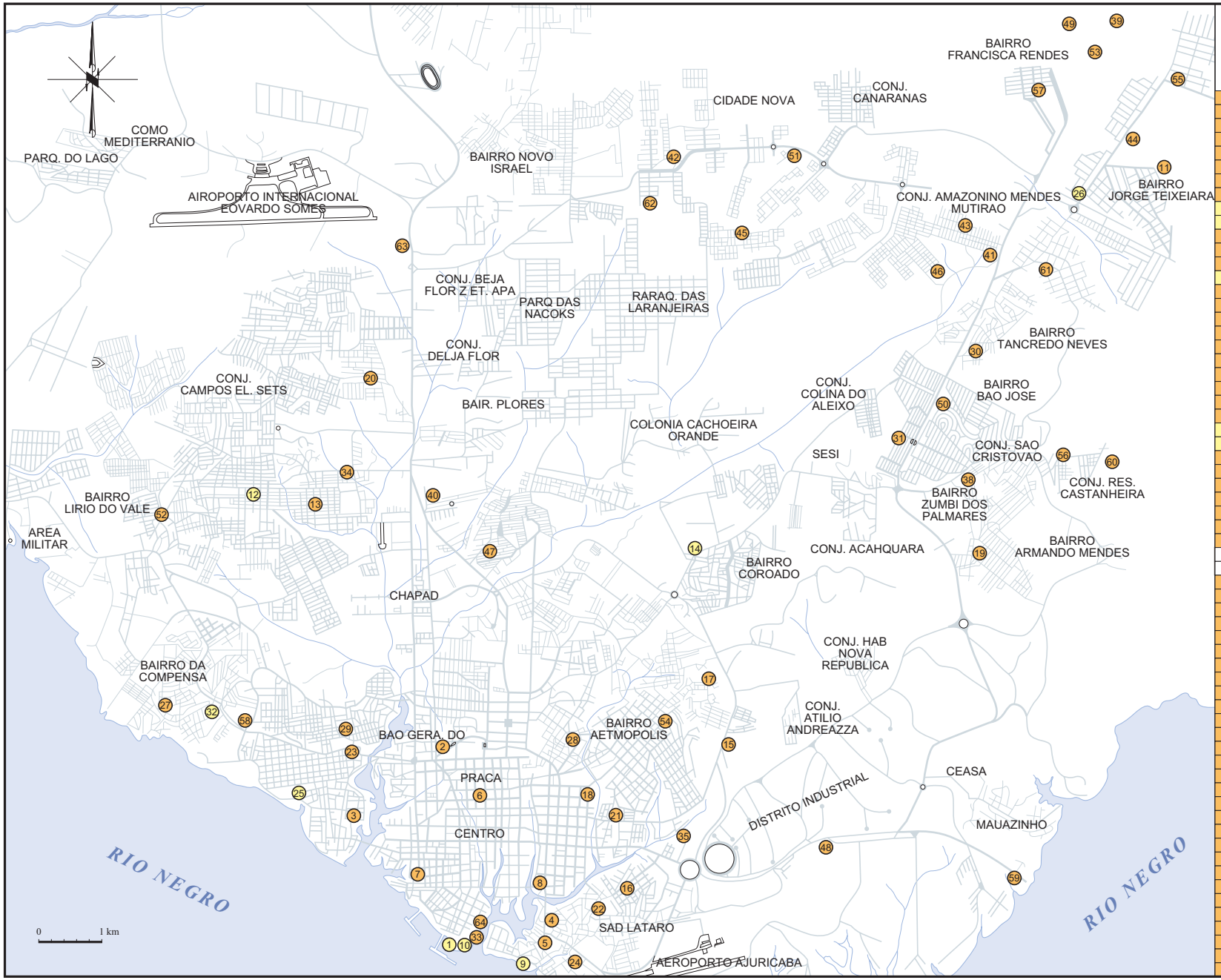

Figure 5.6.2-2 Location Map of Municipal Market

1	Mercado Adolfo Lisboa
2	Mercado Dorval Porto
3	Mercado Araujo Lima
4	Mercado Carneiro da Mota
5	Mercado Jorge de Moracs
6	Mercado Maximino Corres
7	Mercado Senador Cunha Melo
8	Mercado Walter Rayol
9	Feira de Panair
10	Feira Cel. Jorge Teixeira
11	Feira Coberta do Jorge Teixeirs I
12	Feira Coberta do Alvorade II
13	Feira Coberta do Alvorade I
14	Feira Coberta do Coroado
15	Feira Coberta do Japiim I
16	Feira da Bertanis
17	Feira da Japiinlandia
18	Feira da Maues
19	Feira do Armando Mendes
20	Feira do Bairro da Paz
21	Feira do Bairro da Raiz
22	Feira do Cajual
23	Feira do Jardim dos Bartes
24	Feira do Peixe Vivo
25	Feira do Produtor - Sto Antonio
26	Feira do Produtor - Zona Leste
27	Feira do Quarentao
28	Feira do Sao Francisco
29	Feira do Sao Jorge
30	Feira do Sao Jose I
31	Feira do Sao Jose II
32	Feira Modelo da Compensa
33	Feira Modema da Banana / Pav. Ediuardinho
34	Feira Municipal "Joao Sena"
35	Feira Municipal do 40
36	Feira Volante do Prefeito I
37	Feira Volante do Prefeito II
38	Feira Comunitaria II de Outubro
39	Feira Comunitana Palmeiras
40	Feira Comunitaria da Uniao
41	Feira Comunitaria Amazonino Mendes
42	Feira Comunitaria de C. Nova I
43	Feira Comunitaria do Mutirao
44	Feira Comunitaria Nova Luz
45	Feira Comunitaria Amadeu Botelho
46	Feira Comunitarai de Vitoria
47	Feira Comunitaria do Parque 10
48	Feira Livere do Japiim
49	Feira Comunitaria Santa Luzia
50	Feira Comunitaria Novo Aripuana
51	Feira Livre da Cosama
52	Feira da Amizade
53	Feira da Cidade de Deus - Santa Marta
54	Feira de Petropolis
55	Feira Comunitaria Avrton Senna
56	Feira do Castanheira
57	Feira Livere do Oswaldo Frota
58	Mini-Shopping - NAC
59	Feira do Ceasa
60	Feira da Grande Vitoria
61	Feira Comunitaria Beija Flor
62	Feira do Riacho Doce
63	Feira do Acroporto
64	-

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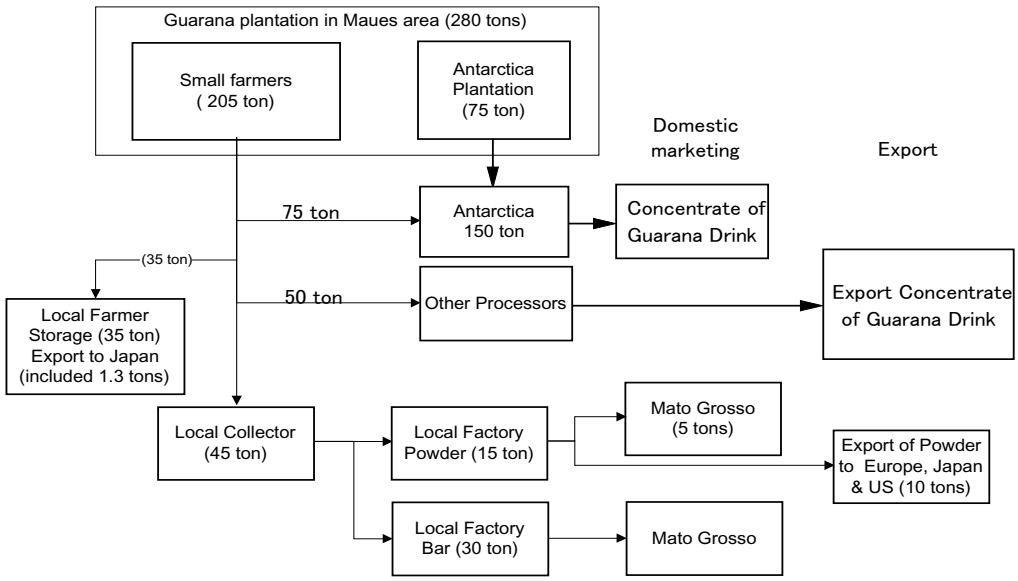


Figure 5.6.3-1 Marketing Flow of Guaraná from Maués Municipality

Maués guaraná farmer has the following basic options for distribution of his crop: 1) sell to a beverage company, 2) sell to a local processor of bars/powder, 3) sell to a collector, i.e., broker, or 4) store the crop and direct marketing. The beverage company makes concentrate for their own soft drinks. The local processors will make bars or powder to sell to mainly Mato Grosso and Manaus. The collectors have the option to sell the roasted guaraná seeds to local processors (such as Santa Claudia) or to processors in other parts of Brazil. It is important to note that most all guaraná leaves the State of Amazonas in some kind of processed form.

(1) Export Marketing of Guaraná Product

Of the approximately 280 tons of guaraná produced in Maués in 1999, an estimated 200 tons was bought by the various beverage companies for the production of soft drink components in Maués and Manaus. The next most important sector affecting distribution is the small - medium size business sector, which produces guaraná bars and powder.

Approximately 80% of officially reported shipments of guaraná products are distributed to the State of Mato Grosso (MT). The demand in Mato Grosso is due to many years of traditional use by the local population, such that guaraná drinks made from freshly scraped bars exceed the local consumption of coffee, tea, and cola products as a daily caffeine source.

Table 5.6.3 -1 Total Distribution of "Registered" Guaraná Product From Maués, 1999

Product	Amount (kg)	% of Total	Primary Destination
Seed (for beverage industries)	200,000	71.4	Manaus
Seed (officially exported)	1,342	0.5	Japan
Powder (officially exported)	2,452	0.8	Mato Grosso
Bars (officially exported)	15,398	5.5	Mato Grosso
Seed, Powder, Bars (estimated unreported consumption)	60,808	21.8	Mato Grosso
TOTAL	280,000	100	

Source: Ministry of Agriculture - Manaus; Antarctica Co.

It is important to note that over 40% of the guaraná and guaraná products produced in Maués are probably "unregistered", i.e. not reported to the Ministry of Agriculture. Most local experts agree that there is a considerable amount of unreported, and technically illegal, trafficking of powder and bars within Manaus and onward to Mato Grosso. This trade will flourish as long as these buyers insist on evading taxes, quality standards and food safety controls.

Another interesting aspect of guaraná distribution is the officially reported export of guaraná concentrate from Manaus to foreign countries. The table below provides a summary of this information. Data provided by the Ministry of Agriculture did not name the exact source for each exportation, but it is assumed that these are companies related to the organized beverage industry. Since approximately 5 kg of seed are needed for 1 kg of liquid extract, we can predict that roughly 44 tons of seed from the beverage industry sector was converted into concentrate for export. This would represent roughly 16% of the seed production of Maués. Evidently there is a lot of demand in Europe for concentrate from Maués seed, as 50% of all these exports went to Portugal and France alone (Table 5.6.3-2). Argentina also imported a considerable amount of the concentrate (32%).

Table 5.6.3-2 Officially "Registered" Export Sales of Guaraná Concentrate from Amazonas, 1999

Importing Country	Guaraná Concentrate (kg)
Paraguay	424
Argentina	2,799
Australia	42
Japan	21
Portugal	3,096
Guatemala	21
Belgium	21
Germany	21
France	1,251
USA	233
Barbados	530
New Zealand	233
Hungary	21
TOTAL	8,713

Source: Ministry of Agriculture-Manaus, Amazonas

(2) Farm to Market

Traders rarely come to the remote villages unless they have some kind of a contract with a community for a specific product. The farmer has no place where he can temporarily store his guaraná. The buyers know they are tired, usually without cash, and with no arrangements for lodging. The buyers take advantage of the fragile position of the farmer and often succeed in lowering the buying price to unreasonable levels.

Most of the time, the small farmers sell to brokers who are conveniently located along the riverfront. The farmers have the option to deliver the crop more directly to SEASA (which is the primary buying station for AmBev) or to small guaraná processors located in town. However, this opinion involves yet another short trip from the riverfront with all the related expenses and uncertain outcome. The obvious preference of the farmer is to sell the guaraná a little more cheaply (but quickly) at the riverfront.

In all three of the communities visited, the ability of the farmers to transport the guaraná crop to market was a often cited as a major constraint to their quality of life. Transport data is summarized in Table 5.6.3-3.

Table 5.6.3-3 Time and Cost of Transport from Rural Communities to Maués

	Transport Time (by cargo boat)	Transport Time (by speedboat)	Transport Cost (R$/50 kg sack)	1999 Guaraná Prod. (kg)
Bom Jesus	-	0.5 hr	3-4 (canoe)	800
S. Nazare	2 hr	1.0 hr	3-4 (canoe)	1,000
P. Alegre	8 hr	2 hr	1-2 (cargo boat)	2,000

Source: Interviews with farmers, 2000

In both Bom Jesus and Nazare, the preferred means of transport is by small canoe boat (rabeta) with a 3.5 hp engine. Several members of the community have these boats, and during harvest season, neighbors make a request to use the boat for a day. Normally, three 50kg sacks of guaraná can fit in the boat along with 1-2 passengers. If the owner of the boat needs to go to town as well, payment is made by sharing the cost for the fuel. Farmers in Bom Jesus can also take their crop by river to a neighboring town, whereby there is bus service into Maués. No large cargo boats ever enter the small river where Bom Jesus is located.

The guaraná farmers of Nazare have a access to a community passenger/cargo boat, but they complain that most of the time it is out of service. During the dry season, farmers from Nazare lose access to the river and must hand carry their produce to a nearby town in order to contract a rabeta boat to Maués.

The community of P. Alegre is the most remote, but it is serviced twice a day by larger passenger/community boats, which make stops in many small villages before reaching Maués.

Also, the procedure of transporting the crop from the family property to the river can be complicated in itself. Feeder roads from the properties to the river points are virtually non-existent. Produce must be carried in primitive carts or by strictly manual labor along unkempt jungle trails in order to reach the docking point with the small boats.

5.6.4 Marketing of Vegetable

(1) Current Condition in the Vegetable Market in Manaus

Partly because the residents in Amazon area originally have not eaten much vegetables, it was very recently that the local vegetable production started, with the creation of the demand by the Japanese settlers and the immigrants from São Paulo following the advance of plants into the free trade zone (ZFM).

In Iranduba, which is one of the study areas in this study, 95% of the yield has been shipped to Manaus. Therefore, it can be said that Iranduba is the very typical suburban-agriculture area. However, each farmer has no warehouse. And there are a

few systems where the produce can be shipped jointly. And the farmers in Iranduba do not have any individual sales channel. Therefore, the actual situation is that quite a little anount of the crops can not be sold to get rotten.

The main shipping areas of the vegetables delivered to Manaus, as shown in Figure 5.6.4-1, can be roughly divided into the two sections, one of which includes the southern states such as São Paulo, and the other of which includes the surrounding villages of Manaus, including Iranduba. The transport from São Paulo is mainly conducted with cargo trucks and refrigerating vehicles. And the sufficient supply of the crops such as poteto and onions, which can not grow in the weather of Amazon area, which has high temperature and humidity, has sustained the demand in Manaus. The crops such as sweet pepper, cabbage, and carrots, which can keep the quality appropriate enough to supply after the ten-day transportation, are transported, using refrigerating vehicles. The crops to easily be damaged, such as broccoli and spinach, are transported by plan.

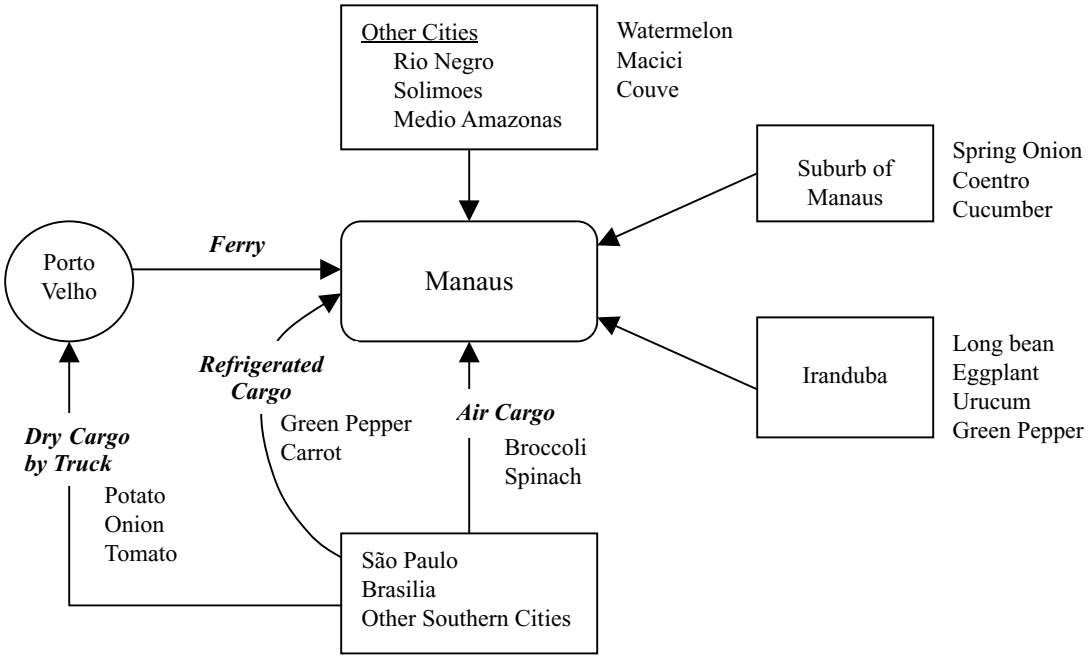


Figure 5.6.4-1 Marketing Flow of Vegetable to Manaus

On the other hand, the conditions of the delivery and sales of the local crops in the market in Manaus are as follows.

From Iranduba: long been, eggplant, sweet pepper, etc.

From the suburban areas of Manaus: spring onion, leaves of coriander, cucumber, cabbage, lettuce, etc.

From the surrounding towns and villages of the Negro river and the Solimoes river: watermelon, cabbage, lettuce, the vegetable called Macici, etc.

As the above-stated, the vegetables consumed in Manaus are roughly divided into the two categories, one of which includes the vegetables imported from the southern

states, and the other of which includes the leaf vegetables produced locally. And both of the above-stated two categories have coexisted. However, some crops such as sweet pepper and tomato have competed one another, from the viewpoints of the qualities and the costs. The transportation from São Paulo can keep the cost price cheap, even if the transportation cost, which can amount to 20 to 30% of the final retail price, is burdened, and can also allow the supply of the sufficient amount. Therefore, a large variety of vegetables can flow in. However, some crops, which need the freshness, from the viewpoints of the transportation time and the cost, and some tasty vegetables that can be produced locally have faced the condition of the mutual competition. And, as of now, the system of the work sharing among areas and the sales channels have not been established. Therefore, the current condition is that the consumption trend can change in every season, depending on the reaction of consumers.

The official statistics of the governmental body have been implemented through the grasp of the amount of the limited items, on which taxes are imposed. And, even if the data are recorded, such data are not compiled into a database. Due to the above-stated condition, the records are scattered and lost. Therefore, there is a little information to grasp the entire condition of the vegetables. In addition, the data on the vegetables, the amount unit of which is bundle or bunch, can not be grasped accurately. Therefore, as only the reference, the amount of the import and the yield shall be shown in Table 5.6.4-1. The total of the import of sweet pepper and the total of the yield in Iranduba are almost equal, which can represent that the competition over sweet pepper has existed.

Table 5.6.4 -1 Officially Registered of Import of Vegetables into Manaus via Manaus International Airport and Roadway Port, 1999

Crop	Total Imports	Total Amazonas*	Total Iranduba*	Imports (as % of Iranduba)
Vegetables				
Green Pepper (kg)	288,216	342,000	288,000	100
Cabbage (kg)	2,211	2,542,000	384,000	<1
Watermelon (#fruit)	1000	4,970,000	381,000	<1
Couve (bunch)	68,545	1,875,000	88,000	78
Lettuce (head)	142,660	9,563,000	1,302,000	11
Hydroponic Lettuce (head)	173,860	0	0	13
Spring Onion (bunch)	8,353	25,461,000	252,000	3
Coriander (bunch)	2,520	5,666,000	972,000	<1
Tomato (kg)	96,688	211,000	108,000	90
Cucumber (kg)	4,130	5,462,000	1,340,000	<1
Eggplant (kg)	15,291	468,000	468,000	3
Fruits				
Banana	3,928	5,568,000	168,000	2
Papaya (kg)	61,034	2,356**	1,180**	5,172
Maracujá (kg)	41,031	3,871,000	324,000	13
Açaí (kg)	2320	240,000	0	0

Source: Ministry of Agriculture-Manaus; *IDAM; **1998 data

(2) Import of Vegetable from Southern States

Market size of Manaus in terms of consumption of major vegetables are estimated by the cargo amount transported into the city of Manaus through the distribution center called CEAZA. Based on the weekly average cargo into Manaus, more than 10 thousand tons of tomato and onion are brought in but because of the damage before the final consumption by people, large quantity is discarded or fed to pigs as distribution loss. Potato on the other hand is less damaged during the distribution, so the estimation by both supply side and consumer side indicate consumption as a little more than 10 thousand tons.

Table 5.6.4-2 Market Size at the City of Manaus Estimated by both Supply and Consumption

	Weekly cargo	Effective ton/cargo	Weekly Consumption (ton)	Annual Supply to Consumer (ton)	Annual Consumption Estimated by National Statistics (ton)
Tomato	12	24	286	14,300	6,516
Onion	10	25	252	12,600	4,703
Potato	10	26	258	12,800	10,669
Frigo Mix	10	24	240	12,000	
Frigo Apple	5	24	120	6,000	
Frigo others	3	24	72	3,600	
Air Cargo			20	1,000	

Source: IBGE, CEAZA and Fruver Com. Imp. E Exp.De Generos Alimenticios Ltda.

The difference between the estimations by supply side and consumer side derives from both transportation damage and statistical bias between national average and Manaus particular. People in southern large cities have much variety of food items so that they do not depend much of their vegetable items on tomato and onion. Historically also, people in the state of Amazonas did not have habit of eating vegetables.

Large volume of vegetables and fruits are imported from Southern region of Brazil such as São Paulo and Brasilia. Those cargoes are traded by specialized traders considering the transportation cost and marketing potentiality.

(a) Dry Cargo

Potato, onion and tomato are the major items transported by dry cargo. In the case of dry cargo, two trucks carrying 14 tons of cargo delivers total of 28 tons of cargo from San Paulo to Porto Velho taking 5 days. At Port Velho two 14 tons of cargoes are consolidated into one trailer of 28 tons and delivered to Manaus taking 4 to 5 days. It takes approximately 10 days in total and the cost for the truck each is R$1,400 and the ferry is R$2,200. So the total cost for transporting 28 tons of cargo is Approximately R$5,000 (1,400 * 2 + 2,200).

After arriving at Manaus, the cargo should be checked and repackaged because of the damage during the transportation. The loss during the transportation is generally 10 % of the original cargo. Therefore the weight after re-packaging reduces onion of 20 kg to 18 kg, potato of 50 kg to 48kg, and tomato of 25 kg to 22 kg.

Commodities transported by dry cargo has price composition exhibited below. The price of commodities carried by dry cargo are generally sold at 1 R$/kg or less, except for onion because of the season at high-price range now for domestic products. Transportation cost for each commodities are a little over 20 cents even if the retail values are different.

Table 5.6.4-3 Composition of Cost in Retail Price in Manaus (Dry Cargo items)

	Price at San Paulo	Transpor-tation Cost	Wholesale margin	Retail margin	Retail Price in Manaus
Potato	0.43	0.22	0.07	0.18	0.91
Onion	0.75	0.22	0.09	0.35	1.41
Tomato	0.32	0.23	0.04	0.51	1.10

Source: Fruver Com. Imp. E Exp.De Generos Alimenticios Ltda. & Original Survey (Unit:R$/ kg)

The ratio of transportation cost in the total retail price is roughly 20%. The price of Potato provides good proportion of cost composition, which is made up with 50% of original purchase price at San Paulo, 20% of transportation, 10% of wholesaler and 20% of retailer.

(b) Refrigerated Cargo

Items with higher retail value than dry cargo such as apples and green peppers are carried by refrigerated cargo. In the case of refrigerated cargo, both trailer and 24 tons of cargo box travels to Port Velho and comes to Manaus by ferry. Most of the cargoes are mixture of several vegetables. Total days of travel is 10 days and costs 8,000 R$ per trailer. Therefore the cost of refrigerated cargo is 0.33 R$/kg. (8,000 / 24,000 kg)

Fruits and vegetables which have generally more than 1.50 R$ per kilo are transported by refrigerated cargo, where the ratio of transportation cost becomes approximately 20 % of the retail value.

Table 5.6.4-4 Composition of Cost for Retail Price (Refrigerated Cargo)

	Price at Sao Paolo	Transp. Cost	Tax & Other Duties	Wholesale margin	Retail margin	Retail Price
Apple	0.67	0.34	0.07	0.14	0.27	1.49
Washed Potato	0.56	0.33	0.00	0.11	0.30	1.30
Green Pepper	0.70	0.43	0.00	0.37	0.50	2.00
Cabbage	0.17	0.33	0.00	0.10	0.45	1.05
Carrot	0.32	0.39	0.00	0.11	0.18	1.00

Source: Fruver Com. Imp. E Exp. De Generos Alimenticios Ltda. & Original Survey (Unit : R$/ kg)

In the refrigerated cargo the wholesaler's margin stays nearly the same level of ratio being 10 % to the retail price. As a rough average, considering that the refrigerated cargoes are mostly mixture of various items, purchase price at San Paulo consists 40%, transportation cost 20%, wholesale margin 10% and retail margin is 30%.

(c) Air Cargo

In the case of Air cargo, obviously high value vegetables and fruits can be

transported from Brasilia or San Paulo. Cauliflower, spinach, broccoli, strawberry, grape, kiwi fruits are major items to be transported by air. Most of them are expensive items with retail price of more than 4.00 R$/kg.

When the regular high value items does not reach one ton, the cargo is consolidated with other vegetables such as large tomato and washed potato, for the purpose of receiving the discount given to the cargo of more than 1 ton. In response to the change of price according to seasons, modes of transportation shifts from dry to refrigerated, or combination of both.

Table 5.6.4-5 Composition of Cost for Retail Price (Air Cargo) (Unit : R$/ kg)

	Price at Brasilia R$/kg	Transp. Cost	Wholesale margin	Retail margin	Retail Price
Cauliflower	1.00	1.30	0.70	2.65	5.65
Daikon	1.20	1.30	1.50	2.00	6.00
Spinach	0.70	1.25	1.06	3.00	6.00
Broccoli	1.00	1.25	0.75	2.99	5.99
Hakusai	0.25	1.05	0.30	1.29	2.89

Source: Fruver Com. Imp. E Exp. De Generos Alimenticios Ltda. & original market survey

Because of the nature of the commodities as high value crop, wholesaler's and retailer's margin together occupies more than 50%, which is higher than any other type of cargo because of the damage caused during the transportation before and after the flight.

(3) Local Vegetable and Competition in Marketing

(a) Local Vegetable

Iranduba vegetable farmers face fierce competition from nearby area of Manaus such as Rio Negro, Solimoes, and Medio Amazonas. Iranduba has clear production dominance in some crops such as green pepper, tomato, urucum, long bean and eggplant, whereas Manaus dominates in lettuce, spring onion, coentro (coriander leaf) and cucumber. Iranduba needs to prepare itself to offer even more competition to Manaus-based growers for a share of this important growth market.

Table 5.6.4-6 Percent Production for Iranduba and Manaus Municipalities for Selected Vegetables in the Combined Growing Areas of Rio Negro, Solimoes, and Medio Amazonas, 1999

Crop	Iranduba	Manaus	Other	Total
Cabbage	17	48	35	100
Green Pepper	85	0	15	100
Couve	5	19	76	100
Lettuce	15	47	38	100
Spring Onion	1	99	0	100
Coentro	19	72	9	100
Tomato	68	0	32	100
Cucumber	26	69	5	100
Watermelon	26	0	94	100
Urucum	100	0	0	100
Maxixe	0	0	100	100
Long Bean	100	0	0	100
Eggplant	100	0	0	100

Source: IDAM Consolidated Trimester Tables, 1999

(b) Competition between import and local

The JICA Study Team has commissioned a study in which over 500 brokers and traders were interviewed at the eight major wholesale vegetable markets in Manaus

(Panair, Adolfo Lisboa, Manaus Modera, Santo Antonio, Alvorada I, FPZ, Leste, Coroado). Among other things, the brokers were asked to indicate a preference for imported (São Paulo) vs. local (Iranduba, Manaus) vegetables according to vegetable type. Broker preference is extremely important since their preference is largely the same as that of their major customer - the supermarkets.

Table 5.6.4-7 Preference for Imported vs. Local Vegetables According to Brokers in Manaus Wholesale Markets

Crop	Prefer Local (%)	Prefer Imported (%)	Crop	Prefer Local (%)	Prefer Imported (%)
Pumpkin	71	29	Coriander	91	9
Lettuce	84	16	Courve	88	12
Garlic	16	83	Long Bean	94	6
Potato	15	85	Watermelon	77	23
Sweet Potato	73	27	Cucumber	84	16
Beet	13	87	Green Pepper	52	48
Onion	15	85	Okra	94	6
Spring Onion	97	3	Cabbage	40	60
Carrot	18	82	Tomato	24	76
Chayote	11	89	Eggplant	47	53

Source: JICA/IDAM research with eight Manaus wholesale markets.

Based on the previous two tables, four distinct categories of vegetables can be discerned: i) those dominated by Iranduba, ii) those dominated by imports, iii) those of mixed preference, and iv) those which cannot be grown in Iranduba due to agronomic reasons:

Table 5.6.4-8 Categorization of Iranduba Vegetables by Market Potential

Iranduba Dominant	Imported Dominant	Mixed	Cannot be Grown Well in Iranduba
Pumpkin	Chayote	Green Pepper	Garlic
Lettuce	Tomato	Cabbage	Potato
Spring Onion	(Papaya)	Eggplant	Sweet Potato
Coriander			Beet
Couve			Onion
Long Bean			Carrot
Watermelon			
Cucumber			
Okra			
(Maracujá)			

Source: JICA Study Team, 2000

As a challenge to the economic threat posed by importation, based on the preliminary data from the above three tables, Iranduba farmers would be encouraged to focus on the following five crops for the following reasons:

- *Green Pepper*: Because there are significant numbers of imports already, but broker preference is mixed, providing a market opportunity.
- *Lettuce & Tomato*: Due to the significant numbers of imports. Brokers prefer imported tomato only because local tomato is scarce and small-sized. They are very unhappy with the quality of imported tomato which is too hard and tasteless.
- *Cabbage & Eggplant*: Because there are not yet high numbers of imports, and since broker preference is mixed there is a market opportunity.
- *Maracujá*: Because it sells well in Manaus and imports are on the rise.

(4) Marketing by Iranduba Farmers

Although each locality is different, all of these farmers have a high dependence upon the Iranduba/Manaus ferry service for the distribution of their produce. In addition

to the passenger fare, freight costs on the ferry are expensive, such that a seck of corn costs 1R$, 100 pumpkins cost 10 R$, a box of tomatoes or cucumbers cost 0.5 R$. During harvest season, most farmers make 1-2 trips to Manaus per week. They either accompany the produce themselves or send it on with a trusted representative from the community to delegate people's crop.

The island dwellers of Jacarutu have no regular boat service so they usually hire a small boat (rabeta) from a neighbor, bring their crop to Iraduba town, take a bus to the ferry port, load the produce off the bus onto the ferry, off load at Manaus port and then take a bus to a nearby market in search of a buyer. Or, at any point along this chain they will sell to a broker if they think the price is fair. However, Jacarutu farmers are very independent and avoid brokers whenever possible.

Costa Iranduba farmers traditionally sell to brokers especially heavy produce such as watermelon, because road access to this area is good and it is frequented by brokers with trucks looking for produce. The farmers are more likely to bring lightweight produce such as spring onions or leaf vegetables to Manaus on their own.

Jandira farmers have a more collective approach to selling their produce than other localities. A municipal truck collects produce from the farmers and travels to Manaus markets twice per day in search of buyers at the major markets. Usually a community representative accompanies the shipments and serves as a middleman. Generally, the farmers must pay for fuel only, but the driver and the representative surely pocket some percentage of the sales proceeds. Due to the good roads, Jandira farmers are particularly interested to develop a formal selling post in Iranduba town.

5.6.5 Marketing of Tropical Fruits

There is very little transportation of fruit or processed fruit products out of Amazonas. In fact, Amazonas actually imports significant amounts of fruit and pulp products from the southern states. This is maily because there is a significant internal demand for the products in Manaus, and export quality requirements are very difficult for Amazonian food processors to meet. Very limited amount is traded outside of the state such as Cupuasu Juice to neighboring states and frozen pulp to São Paulo.

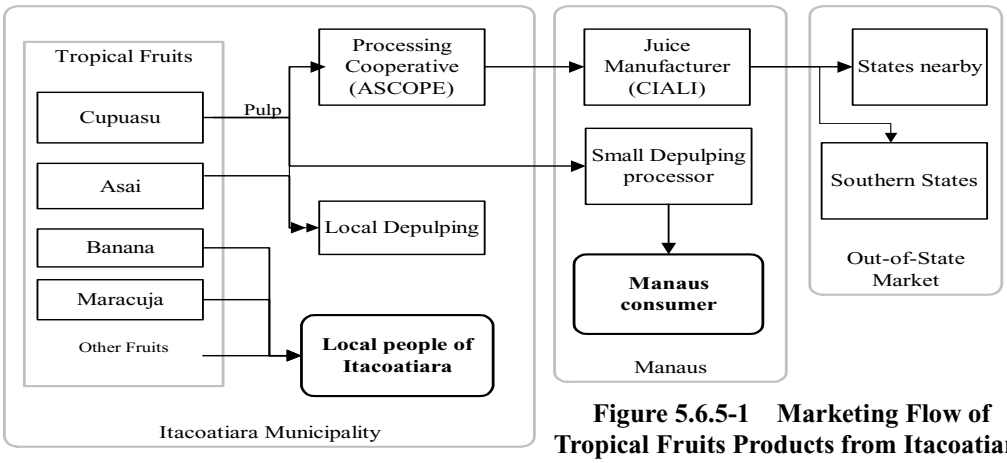


Figure 5.6.5-1 Marketing Flow of Tropical Fruits Products from Itacoatiara

Most of the regional fruits that are shipped to Manaus arrive by boat, and all of this inter-regional transportation is characterized by very poor infrastructure such as lack of a cold chain and lack of proper packing materials, which significantly decreases post harvest quality of the fruits.

Variations of product from tropical fruits are listed in Table 5.6.5-1.

Table 5.6.5 -1 Product Variety of Amazonas Fruits

Name	Part	Product / Forms to be marketed	Market (Current and Potential market)
Guarana	Seed	Stick	Mainly local
		Powder	National & International
		Drink (essence)	National & International
Cupuasu	Pulp	Juice	Mainly local
		Jam	Local (potential)
	Seed	Chocolate	International (potential)
	Shell	Fertilizer	Local
Asai	Pulp	Juice	Local & National(potential)
Pineapple	Fruit	Whole fruit	Local
	Pulp	Juice	Local & National(potential)
		Canned fruits	International (potential)
Passion fruit	Pulp	Juice	Local
	Fruit	Whole fruit	Local
Banana	Fruit	Whole fruit	Local
		Chips	Local

The production of juice from these tropical fruits are still in the level of low utilization because of the following reasons.

a) Collection of fruits is difficult because farmers are in the remote area
b) Fruits availability for processing is limited to only 5 days after natural drop
c) Harvest season is limited to only 3 months
d) Quality control of hygienic level is costly for local processor

Cupuasu makes juice from its pulp and chocolate from its seed. According to the processor, more than 50% of the fruit of cupuasu is discarded in the field because there are no sufficient means of transportation and local market does not absorb supply when the season comes.

Juice from fruits pulp do not reach the whole domestic market yet. In terms of volume, the consumption of soft drink in Brazil is estimated as 3 million tons per year and fresh juice consumed is only less than 200 thousand tons according to the national consumer survey by IBGE. If the price is reasonable and quality is acceptable, increase of juice production will be absorbed in the market of major cities of Brazil.

Passion-fruits and banana are cultivated in various areas of Brazil and the State of Amazonas is not in advantageous place. In the case of, Pineapple and Banana whole fruit is the major form of consumption and mainly consumed within the state.

(1) Marketing of Farmers

Small farmers in remote communities have to have access to a community boat, or must wait for a scheduled passenger boat to take them all the way to Itacoatiara port. Farmers who live closer will take a small boat (rabeta) to a point where they can connect to a road and find access to a public bus. Fruits are sometimes bagged but are often transported loose, without any packaging whatsoever. Bus charges range

from 4-6 R$/person (round trip) plus an additional 3-4 R$ per 100 fruit. Many who encounter brokers along their journey will sell the produce at a reduced price. Typically, large size pineapple that can be sold for 1R$ in the market might be sold to a broker along the route at 0.3 R$/fruit.

A high percentage of Itacoatiara farmers use public buses to transport their goods to market. Most all farmers interviewed indicated that pineapple was relatively easy to sell year round - they almost always sell all the fruits brought to the market. Banana is different - often 25-30% fails to be sold. Cupuaçu pulp is the most difficult - they often only manage to sell 50%. They would like to plant more maracujá because they sense it is always in high demand from the brokers and the supply is always limited.

Manaus market: Certain farmers that are a bit more organized and less afraid of risk, transport their crop to the Manaus market. This is generally done on large, regularly scheduled passenger boats. Approximately 40 bunches are packed into a styrofoam box and 3-5 boxes might be managed per trip. The boats will charge freight of 2-3 R$/box. The hope of the farmer is to sell his banana at 2-3 R$/bunch to a wholesaler in Manaus. If he is lucky, he may be able to sell to a retailer at 3.5 R$/bunch. Pineapple can also be transported in this fashion.

Some small farmers also transport their pineapple or banana by road to Manaus provided that they have access to friends with small trucks. However, most of the fruits arriving by truck in Manaus are managed by brokers, not small farmers. Small farmers prefer river transport because it is considerably less expensive.

A high percentage of the banana and pineapple from Itacoatiara municipalities is sold at the central farmers market. The market is open from Thursday to Saturday, and any farmer can sell there without any fee. Booths are allocated on a first come first serve basis. Technically, brokers are not allowed to use the market – although a few of those interviewed admitted to being “farmer/brokers”. Fruits are usually marketed in three size ranges (large/medium/small).

5.6.6 Marketing of Fishes

(1) Marketing Channel

(a) Wild-caught fishes

Marketing channel of freshwater fishes in the Amazonas State is schematically shown in Figure 5.6.6-1. At major fish landing places like the Adolfo Lisboa and Panair in Manaus, ship owners ask middlemen to sell fishes to retailers and institutional buyers such as restaurant and hotel. Middlemen negotiate the price with retailers and receive 10% of the selling price from the ship owners. In this sense, middlemen of the Amazonas State are considered to be agents of ship owners. After the agreement, retailers transport fishes by their own expenses and sell to consumers.

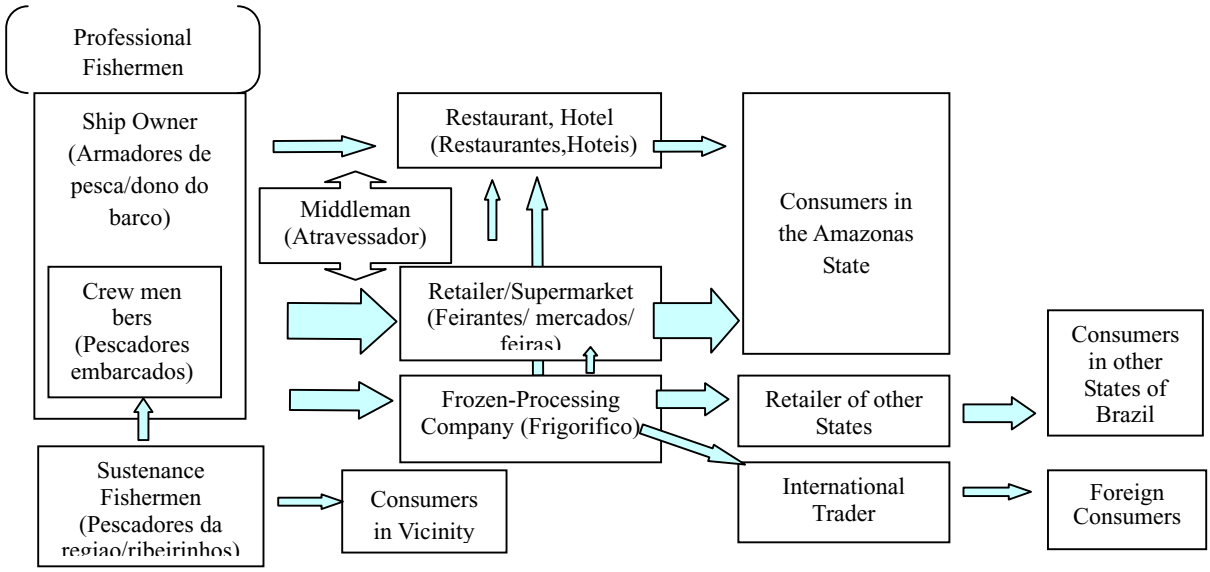


Figure 5.6.6-1 Schematic Drawing of Fish Marketing Channel in the Amazonas State

Remark: 1) This channel is prepared based on the situation of Manaus and its vicinity
2) Size of arrows indicates relative quantity

Some amount of fishes caught by subsistent fishermen are transported by fish venders using passenger's boat and directly marketed for retailers. In addition to the above marketing channels, role of frozen-processing companies (frigorifico) is important in the State. Majority of catfishes are sold directly to them for domestic trade as well as local consumption. In this case, frigorificos in Iranduba rent fishing boat owners operational budget of fishing trip and deduct credit from their fish landing. On the other hand, this system is not applied in Itacoatiara, where fishermen sell fish to any frigorificos or fish markets.

International export of frozen fish was carried out by some frigorificos. The export amount reached to be 543 tons or US$ 1.8 million mainly for USA in 1994 (Annex 5.6.6-1). However, the amount decreased thereafter and finally the export has been ceased after 1998 until 2001.

(b) Cultured fishes

Marketing channel of cultured fishes is basically the same as wild-caught fishes. Large-scale fish farms sell cultured fishes in fresh state or alive, directly to supermarkets, while small-scale farms usually ship the product to fresh fish markets. Significant portion of small-scale farm's harvest is consumed by themselves. When fish unloading is much larger than demand in Manaus, unsold surplus fishes specifically those with low marketing value are often discharged to the river in front of fish landing places. Jaraqui is known as one of those species because of its high peak in fishing. This is one of the most serious problems on current fish marketing system here.

A part of fishes is said to be marketing in fresh or dried state to Peru and Colombia by boat, or sold for buyers of those countries on the river stretches. However, such activities are usually not reported to the custom and hardly to grasp the truth accordingly.

(2) Fish Price

(a) Retail price

Fish price monitoring data of Marketing Survey by JICA Study Team were consolidated for major three markets of Manaus namely Manaus Modeira, Panair and Adolfo Lisboa (Figure 5.6.6-2). This is the only available data series on the fish price now. Although size of fish monitored is not indicated and unit is different by species, general tendency of price change in retail market can be explained as follows:

At first it can be pointed out that seasonal fluctuation of price is very large in smaller characiforms species (jaraqui, pacu, matrincha, curimata) which are caught abundantly with high seasonal fluctuation comparing to other relatively large-size species (Tambaqui, Pirarucu, Surubim, Tucunare). This indicates that market demand for the latter species is relatively consistent throughout the year.

Approximate negative relationship between fish price and fish unloading amount (Figure 5.5.4-1) is observed for pacu and curimata but not clear for jaraqui and matrincha. In the case of jaraqui, which is the dominant species in Manaus market, it is plausible that retail price is controlled not only by its own marketing amount but also by total fish marketing amount and/or market policy of retailers.

About absolute fish price, pirarucu (in a form of manta or fillet) and tambaqui maintain relatively high level as about R$ 7.00/kg and R$ 6.00, respectively comparing to surubim and tucunare as about R$ 3.00/kg each. It is no doubt that the former species are better and recommendable target species for aquaculture when production cost is the same.

(b) Producer's price

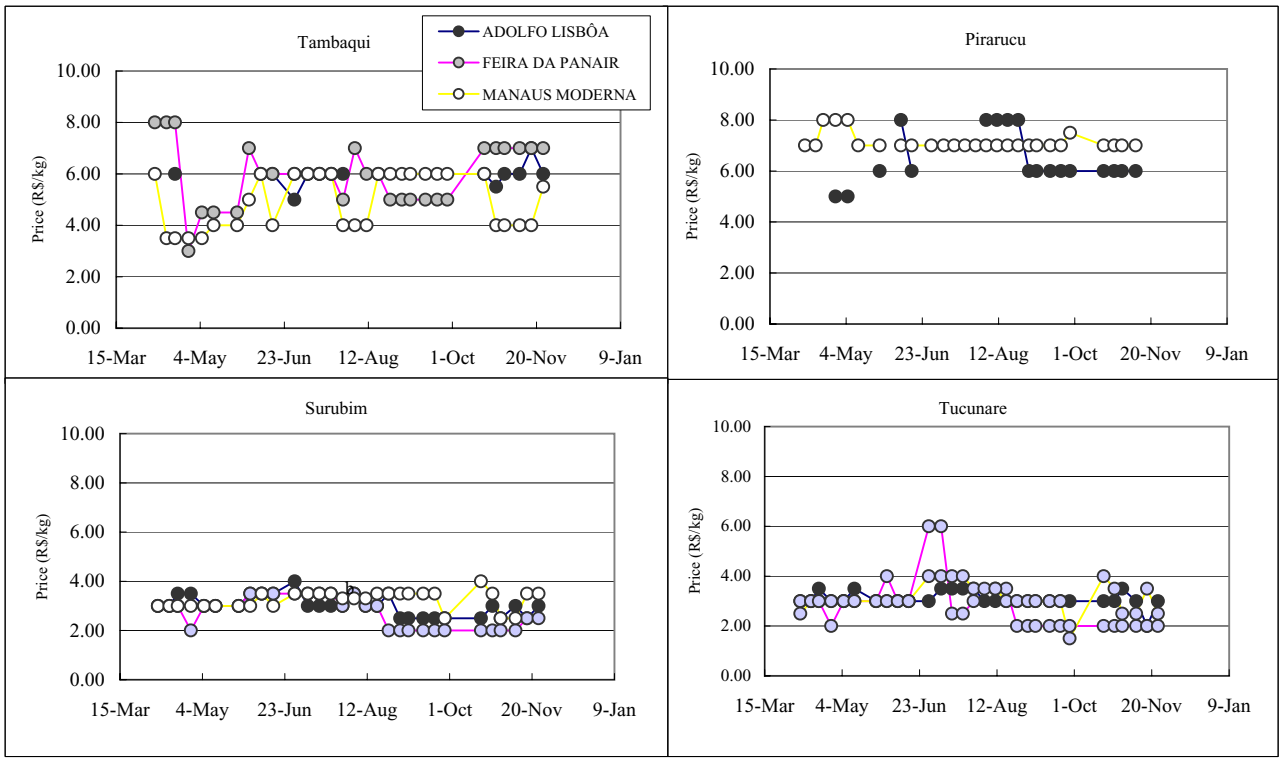
Approximate producer's price was investigated by interview to several owners of fishing vessels of FEPESCA/AM/RR as shown in Table 5.6.6-1. Fish price varies largely due to the size of fish and fishing season. Unit price is higher when fish size is larger. Considering the aforementioned retail price, It is understood that margin of retailers would be as high as 100% or more for jaraqui and matrincha and 30-40% for tambaqui, pirarucu and surubim.

Figure 5.6.6-2 Current Producer's Price of Priority Fish Species due to the Size and Fishing Season

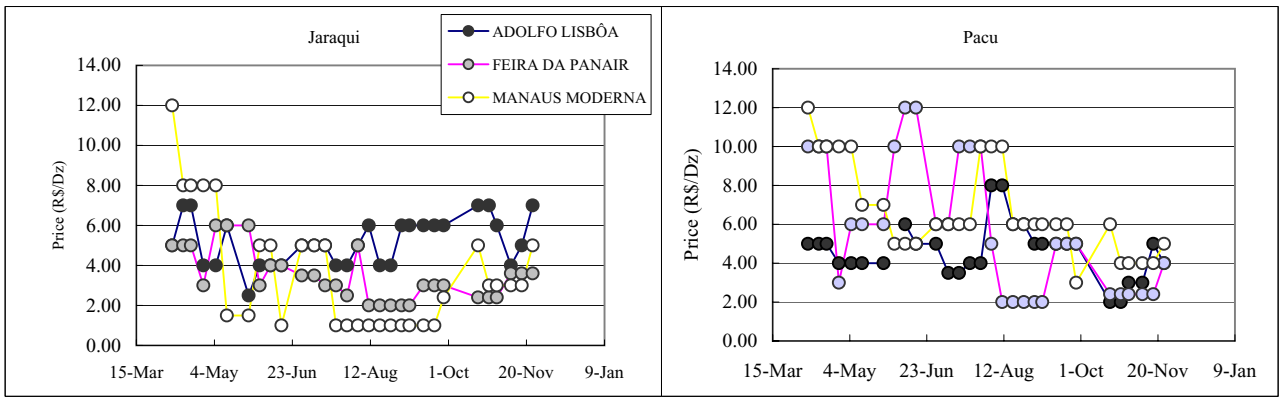
	Size (kg/ individual)	Producer's Price(R$/kg)		Peak / Lean Ratio
		Peak Fishing Season	Lean Fishing Season	
Jaraqui	0.1	0.1	0.2	2.0
	0.2	0.4	0.8	2.0
	0.3	0.6	1.0	1.7
Matrincha	0.3	0.8	1.4	1.8
	0.8	1.2	2.5	2.1
	1.5	2.2	4.0	1.8
Pirarucu	Fillet	4.5	5.0	1.1
Surubin	2.0	1.0	1.6	1.6
	4.0	1.7	2.4	1.4
	8.0	2.0	2.8	1.4
Tambaqui	3-4	3.0	3.5	1.2
	4-8	4.0	5.0	1.3
	8-15	5.0	6.5	1.3
	15-20	6.5	7.0	1.1

Source：Interview to EPESCA/AM/RR in 2000

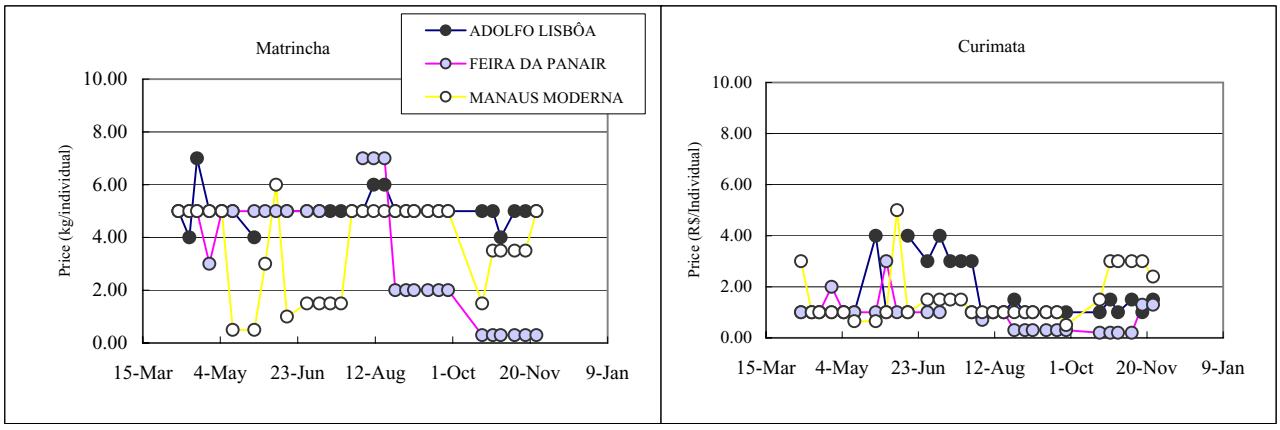
1) Species monitored in a unit of kg



2) Species monitored in a unit of doezen



3) Species monitored in a unit of individual



Source: Marketing Survey by JICA Study Team (Panair), 2001

Figure 5.6.6-2 Retail Price of Fishes in the Three Major Fish Markets of Manaus (From February 2000 to January 2001)

5.7 Farmer Economy

5.7.1 Guaraná

(1) Household Economy

Based on information from the RAA and Questionnaire Survey (RRAQS), it is possible to characterize the household economy of a typical guaraná farm family in Maués. Although the RRAQS only interviewed 90 farm families in the three communities of Bom Jesus de Pupunhal, Ns. Nazare, and Ponto Alegre, the following information (averaged over the 3 villages) can be assumed to be representative of most guaraná-based communities in the municipality. In general terms, the average guaraná household has a holding of 53 ha, but only 5 ha are planted to crops. Since the average family size is about 6.0, this means the average planted area per family member is a little under 1 ha.

All 90 families interviewed plant guaraná and cited it as their second most important crop behind cassava. Due to marketing difficulties, only 63% of the harvested crop could be sold in 1999/2000:

Some estimates on the general breakdown of family income are noted below:

Table 5.7.1-1 Income Breakdown Per Household in Maués Communities

Type of Income	Value (R$)
Total Annual Income	3,540
Total Annual Income Per Capita	809
Total Annual Income from Agriculture, Livestock, & Extractivism (Hunting/Fishing)	978
Total Annual Income from Agriculture (Crops)	787
Total Annual Non-Farm Income	2,562

Source: RRAQS, 2000

With an annual expendable income of less than R$ 4000, it is obvious that the typical guarana-based family household in rural Maues is quite poor. Surprisingly, only about 28% of their household income comes from activities in agriculture, livestock, and extractivism. Non- agricultural income is significant (78%) and is largely comprised of pension money from the senior household members and cash income derived from the adult males (daily labor activities).

Farmers cite the current low prices for guarana as one of the major reasons for their poverty. Although farinha prices have remained fairly steady over the last 5 years (13-15 R$/sack), guarana prices have been reduced from levels of 8-10 R$/kg to levels of 3-5 R$/kg. Additionally, yields have steadily declined due to lack of farmer ability to buy inputs and spend time with crop management.

(2) Farm Level Economy

Price: The economics of farm level production are currently a major concern for the small guarana farmer of Maues. Prices have declined from 8-10 R$/kg in recent

years to current lows in the range of 4-6 R$/kg.. The federal government has recently established a minimum support price for guarana at 4.6 R$/kg for members of officially recognized cooperatives. If the coooperative fails to sell the grain at this level, the federal government is supposed to make up the deficit. Although the federal support price law exists, it is not being enforced in Maues. The reality is that some farmers receive the support price 4.6 R$/kg, many others receive less, a few recive more. Based on conversations in the three communities, it appears that the average Maues farmer received about 5 R$/kg during the 1999 harvest.

Yield: Published yield data for guarana is highly variable and largely inaccurate. Reliable data can only be obtained by talking directly with the farmers and experienced guarana researchers. Yield information from the Maues area is highly variable because many farmers have recently chosen to abandon important crop management practices such as fertilization, weed control, and pruning). This is because prices have dropped so much from previous levels that they believe their time is better spent on other areas of the farm (cassava production, fishing, hunting, etc.). In other words, they are allowing the fields to decline and will only start to take care of them once prices have, in their opinion, significantly improved. The following is a summary of current yield information from the Maues area (Table 5.7.1-2).

Table 5.7.1-2 Yield Information for Maues and Other Areas, 1999

System	Gr/tree	Kg/ha
Maues traditional*	100	40
Maues traditional (restored)**	350	140
Maues Improved Clone (field) +	800	320
Maues Improved clone (expt'l)	1000	400
Mato Grosso average (1999)	1450	580
Bahia average (1999)	1250	500
Amazonas average (1999)	575	230

* traditional= old orchard (10 yrs or more); Assumes average of 400 plants/hectare

** Restored= old orchard renovated with use of recommended cultural practices

+ Impr. Clone = new orchard planted w/Embrapa improved variety under actual conditions (field) or at research farm (expt'l)

Source: Interviews with farmers, Embrapa, IBGE (1999)

Traditional farmers who are letting their trees decline are only obtaining 40 kg/ha. Those who are taking the time to employ a reasonable level of fertilization, weeding, and pruning are obtaining 140 kg/ha. Those using new improved clones and a minimum of management are obtaining 320 kg/ha. Improved clones under the favorable conditions of the Embrapa research farm are yielding 400 kg/ha.

The basic problem for the farmer is a circular one between price and yield. The longer he waits for an improvement in price (and refuses to take care of the trees), the more his yield deteriorates and the less profitable his situation becomes. Only through investment of money and time will his yields improve to the point where his operation can become profitable at a fixed price level for the crop. Since the vast majority of his trees are old, the only chance he has is to take good care of them and hope that there is yield recuperation. Of course he can plant the new improved clones, apply proper crop management, and eventually obtain high yields and good profit - but that will take a large initial investment, and profits will not be obtained

for 3-4 years. The solution is for him to use proper agronomic techniques so that his trees can recuperate (at the same time, he can only hope for some improvement in price from the buyers).

In summary, the current solution for the small Maues farmer is recuperation of existing trees through improved agronomic techniques.

(3) "Quality of Life Analysis"

Farmers in the three communities were asked what type of revenue they expected from their guarana fields in order for them to have a decent "quality of life" based largely on guarana production. The answer was that they expected the crop to obtain at least two minimum salaries for them per month on a year-round basis (minimum wage = 150 R$ x 2 = 300 x12 months = 3600 R$). Thus, the farmers felt that a yearly target profit of 3600 R$ was necessary in order for them to consider a future, comfortable life based on guarana farming.

Table 5.7.1-3 describes the basic maintenance costs for 1 hectare of guarana as currently utilized by the typical farmer in Maues:

Table 5.7.1-3 "Actual" Annual Maintenance Costs for 1 ha of Guarana in Maues

Item	Unit	Amount	Unit Cost (Rs)	Total Cost (Rs)
Mulching	Man/day	-	-	0
Weeding/Pruning	Man/day	15	6	90
KCl	Sack	-	-	0
MgSO4	Sack	-	-	0
Urea	Sack	-	-	0
Borax	Kg	-	-	0
ZnSO4	Kg	-	-	0
Super3Phosp	Sack	2	35	70
Fertilizing	Man/day	3	10	30
Insecticide	Liter	-	-	0
Apply Insect.	Man/day	-	-	0
TOTAL				190

Source: Farm interviews in Maues communities, Oct. 2000

Therefore, the actual maintenance costs for a typical guarana farm at present are about 190 R$/ha. The next table employs a sensitivity analysis showing expected revenues vs. the profit target of 3600 R$ under five possible price situations. Yield and crop management conditions are described as "actual". The model utilizes a farm size of 5 hectares. This farm size was chosen as it is representative of an average farm size for the three communities studied, and it is the farm size often mentioned by Embrapa as being ideal for small farmer guarana production in Maues.

Combining this information with actual, current yields in Maues leads to the following analysis for a typical 5 ha farm (Table 5.7.1-4).

Table 5.7.1-4 "Actual" Economic Model for 5 ha of Guarana Crop Production in Maues at Four Market Price Levels

	7 R/kg	6 R/kg	5 R/kg	4 R/kg
Maintenance Cost (Yr 3)*	950	950	950	950
Annual Production Revenue**	1,400	1,200	1,000	800
Annual Profit	450	250	50	(150)
Profit Target +	3,600	3,600	3,600	3,600
Target Surplus (deficit)	(3,150)	(3,350)	(3,550)	(3,750)

* Based on interviews with farmers (190 R x 5 ha)
* *Based on a yield of 40 kg/ha on a 5 ha farm
\+ Based on a "quality of life" target of two minimum wages/month

Therefore under current conditions, the farmers are making some money on their crop as

long as the market price is 5 R$/kg or higher, but these amounts are too small to give them any kind of satisfaction or motivation to continue as guarana farmers – because even at a price of 7 R$/kg they are far away from the profit target of 3600 R $ required for a desired "improved quality of life".

Table 5.7.1-5 Recommended Annual Maintenance Costs for 1 ha of Guarana in Maues

	Unit	Amount	Unit Cost (Rs)	Total Cost (Rs)
Mulching	Man/day	3	6	18
Weeding/ Pruning	Man/day	104	6	624
KCl	Sack	1	35	35
MgSO4	Sack	4	35	140
Urea	Sack	2	35	70
Borax	Kg	5	1	5
ZnSO4	Kg	5	1	5
Super3Phosp	Sack	2	35	70
Fertilizing	Man/day	6	10	60
Insecticide	Liter	1	20	20
Apply Insect.	Man/day	2	20	40
TOTAL				1,087

Source: Embrapa, 1999

Table 5.7.1-5 describes the annual maintenance costs for 1 ha of guarana as recommended by EMBRAPA. This would be a "high maintenance" mode.

Table 5.7.1-6 applies the previously used price sensitivity analysis to the "ideal" or "high maintenance" model for the same 5 ha farm.

Table 5.7.1-6 "Ideal" Economic Model for 5 ha of Guarana Crop Production in Maues at Four Market Price Levels

	7 R/kg	6 R/kg	5 R/kg	4 R/kg
Maintenance Cost (Yr 3)*	5,435	5,435	5,435	5,435
Annual Production Revenue**	14,000	12,000	10,000	8,000
Annual Profit	8,565	6,565	4,565	2,565
Profit Target +	3,600	3,600	3,600	3,600
Target Surplus (deficit)	4,965	2,965	965	(1,035)

* Based on interviews with Embrapa (1087 R x 5 ha)
* * Based on a yield of 400 kg/ha on a 5 ha farm
\+ Based on a "quality of life" target of two minimum wages/month

So, under "ideal" conditions of yield and crop maintenance, a 5 ha guarana farm would satisfy the "quality of life" requirement at market prices of 5 R$/kg, or greater.

In Table 5.7.1-7, a final "compromise" model is proposed which describes a situation whereby the farmers invest at least a "medium-level"of amount of time and money on crop maintenance in order to obtain an acceptable level of profitability.

Table 5.7.1-7 "Medium-level" Annual Maintenance Costs for 1 ha of Guarana in Maues

	Unit	Amount	Unit Cost (Rs)	Total Cost (Rs)
Mulching	Man/day	3	6	18
Weeding/ Pruning	Man/day	30	6	180
KCl	Sack	1	35	35
MgSO4	Sack			0
Urea	Sack	2	35	70
Borax	Kg			0
ZnSO4	Kg			0
Super3Phosp	Sack	2	35	70
Fertilizing	Man/day	6	10	60
Insecticide	Liter			0
Apply Insect.	Man/day			0
TOTAL				433

Source: Farmer interviews, Maues 2000

This reduced, but manageable level of maintenance should lead to yield levels of at least 200 kg/ha, which leads to the "compromise" model described in Table 5.7.1-8.

Table 5.7.1-8 "Compromise" Economic Model for 5 ha of Guarana Crop Production in Maues at Four Market Price Levels

	7 R/kg	6 R/kg	5 R/kg	4 R/kg
Maintenance Cost (Yr 3)*	2,165	2,165	2,165	2,165
Annual Production Revenue**	7,000	6,000	5,000	4,000
Annual Profit	4,835	3,835	2,835	1,835
Profit Target +	3,600	3,600	3,600	3,600
Target Surplus (deficit)	1,235	235	(765)	(1,765)

* Based on interviews with farmers (433 R x 5 ha)
* * Based on a yield of 200 kg/ha on a 5 ha farm
\+ Based on a "quality of life" target of two minimum wages/month

Using the "compromise" model of medium crop maintenance, the farmer makes a reasonable income at all price levels, and meets the "quality of life" target at a price of 6R$/kg.

Of course, an easier way for the farmers to add more revenue is to simply expand their planted areas – but if this expansion is not accompanied by an adequate investment of time and money for crop maintenance, the initial high cost of land clearing and seeds will not be recovered for a long time. Therefore, a "supplemental" model is proposed whereby in addition to a "medium-level" of maintenance on their existing 5 ha, it is recommended that all farmers plant only one additional hectare in order to increase farm size. Importantly, this hectare should be intensely managed using the improved Embrapa clones and the recommended crop maintenance schedule. This "supplemental" hectare planted to the clones would become fully productive in only 3 years, thus leading to the following incremental profits (Table 5.7.1-9).

Table 5.7.1-9 Economic Model for 1 ha of "Supplemental" Guarana Crop Production in Maues at Four Market Price Levels

	7 R/kg	6 R/kg	5 R/kg	4 R/kg
Maintenance Cost (Yr 3)*	1,087	1,087	1,087	1,087
Annual Production Revenue**	3,360	2,880	2,400	1,920
Annual Profit	2,273	1,793	1,313	833

* Based on interviews with Embrapa
* * Based on a yield of 480 kg/ha

When the one hectar of "supplemental" guarana is combined with the 5 ha of guarana produced in the "compromise" model, the following "mixed" profit scenario is reached (Table 5.7.1-10).

Table 5.7.1-10 "Mixed" Economic Model for 5 ha of Guarana with "Medium" Maintenance, and 1 ha of "Supplemental" Guarana Using High Maintenance

	7 R/kg	6 R/kg	5 R/kg	4 R/kg
Annual Profit (5 ha)*	4835	3835	2835	1835
Annual Profit (1 ha)**	2273	1793	1313	833
Total Profit (6ha)	7108	5628	4148	2668
Profit Target (Annual)+	3600	3600	3600	3600
Target Surplus (deficit)	3508	2028	548	(932)

* Based on yield of 200 kg/ha
* *Based on a yield of 480 kg/ha
+Based on a "quality of life" target of two minimum wages per month

Table 5.7.1-10 indicates that the small farmer in Maues with an average farm size of 5 ha, should become motivated to continue cultivating gua--rana if he adopts a medium level recovery program for the existing 5 ha of old trees, while adding on 1 ha of new clones with an intensive management package. In such a scheme, even the currently low price of 5 R$/kg would give a satisfactory return that would boost his "quality of life" and encourage him not to abandon his guarana fields. In order for him to pursue this approach, he must invest as soon as possible in the planting or "start up" costs associated with 1 ha of improved clones. These costs are estimated in Table 5.7.1-11.

Table 5.7.1-11 Planting Costs for 1 ha of Cloned Guarana in Maues

Item	Unit	Amou -nt	Unit Cost (Rs)	Total Cost (Rs)
Seedling prep.	Man/day	6	6	36
Digging holes	Man/day	20	6	120
Super3Phos	Kg	64	0.7	45
Chicken Dung	Sack	40	3	120
Close Holes	Man/day	15	6	90
Sourcing shade leaves	Man/day	12	6	72
Clones	1 unit	440	2.5	1,100
Transport of clones	Man/day	4	6	24
Planting	Man/day	8	6	48
Shading	Man/day	4	6	24
TOTAL				1,679

Source: Interview with Embrapa – Maues, Oct. 2000

Table 5.7.1-12 Total Capital (R$) Required for a 3 year Maintenance Program for 5 ha of Old Trees and a New Planting of 1 ha (Clonal Material)

	Year 1	Year 2	Year 3	Total
Maintenance for 5 ha ("medium" level)	2,165	2,165	2,165	6,495
Plant 1 ha (clones)	1,679	0	0	1,679
Maintenance for 1 ha (clones)	1,087	1,087	1,087	3,261
TOTAL	4,931	3,252	3,252	11,435

Source: Discussion with farmers, EMBRAPA

Therefore, in order for a Maues farmer to revitalize an existing 5 ha of guarana trees and to plant and maintain one new hectare of cloned seedlings, the following investment capital will be necessary (Table 5.7.1-12).

In summary, a 3 year "yield improvement and stabilization" package for a 6 ha farm in Maues would require an approximate investment of 3800 R$ per year over a 3 year period in order to become economically viable. Therefore, rural credit programs should focus on yearly support levels of around 4000 R$.

In the interest of environmental sustainability, it is considered crucial to adopt this kind of a program which focuses on yield improvement of older trees. Such a program is needed in order to counter traditional farmer tendency to clear new land and plant new crops as means to generate added income.

5.7.2 Vegetables

(1) Present Household Economy

In order to clarify the economic activities and living standards of farmers in the Study area, the farm interview survey with questionnaire was carried out by the Contractor. Based on the Survey report, the municipalities of Costa de Iranduba, Ilha de Jacurutu and Costa de Jandira, Caldeirao were selected for the survey area. 90 completed questionnaires formed the survey sample.

The results of the analysis are summarized in Table 5.7.2-1.

Table 5.7.2-1 Average Household Income in the Survey Area

(Unit: R$/year)

Item	Costa de Iranduba	Ilha de Jacurutu	Costa de Jandira, Caldeirao	Average
Gross Income	5,990	4,150	6.270	5,470
Farm Income	3,820	1,910	4,060	3,260
Off-farm Income	2,170	2,140	2,210	2,110

Source: JICA Study Team, RRA and Farm Economic Survey, 2000

Above table shows that the average farm income of the farmer in the

Survey area in Iranduba is about R$5,470/year. Agricultural income forms 61.4% of total income in Iranduba. There are variations within the sample communities, Ilha de Jacurutu having half the income of the others. Currently the main sources of livelihoods for the communities are small scale agriculture and livestock production, as well as artesanal fishing**.** Forest based activities are less practiced - due to the effects of logging and due to the increase of cropping areas.

Costa de Jandira, Caldeirao have the highest income in the sample. In Costa de Jandira, Caldeirao, the degree of commercialization is significant. Many of the farmers do not plant manioc. They buy farinha from neighbors or in Iranduba. In these rare cases, the farms can be said to have a high degree of market dependence and their farming is basically a commertial activity.

Income from hunting, fishing and extraction of forest fruits and trees is not significant. Average non-farm income for the whole sample is R$2,110, forming 38.6% of total income. There is no difference of non-farm income within the sample communities. The sources for cash income are salaried jobs, pensions, day labor, trading, handicrafts, other services, etc. The main source of non-farm income for the majority is retirement pension.

Per capita annual cash income of Iranduba is R$1,050. That is very low level of income. It is a fact that living condition of most of farmers in the Study area except a few is extreme poverty. The farm economic survey showed a great lack of cash income - many households stating this, to the point of lacking money for purchase of daily necessities. Moreover, at the beginning of cultivation after flooding farmers have the greatest financial difficulty, and many farmers do not have the capital to purchase basic inputs, such as seeds. These problems must be solved as soon as possible.

Major farm income of the farmers in the study area is from the agricultural products. However, this does not imply that the living standard of these farmers are at higher level. The rise in agricultural production cost with high input prices makes profit low. In order to increase profitability, it is necessary to improve both the quantity and quality of crop production, or through the reduction of input, marketing, and transportation costs. Implementation of the research activity and improvement of the effective agricultural support system are necessary to improve the living standard of farmers. Moreover, it will also be considered as an effective countermeasure to strengthen the negotiation capability of farmers through the strengthening of cooperatives. The upgrading of farmers' livelihoods in the study area will make it possible for more effective supporting service. Improved farmers' self-help activities through active farmers organization and will contribute greatly to the development of the study area.

(2) Present Crop Budget and Present Agricultural Production Value

Representative crop budgets have been prepared for the major crops produced in the study area. These are based on published agricultural data, interview with staff of the IDAM and other organizations and farmers interview survey. The production cost includes the total cash cost consist of the seeds, fertilizer agro-chemical, labor and farmer owned material inputs. The detaqiled crop budgets under the present condition are presented Annex 5.7.2-1, while summary is presented in Table 5.7.2-2.

Table 5.7.2-2 Estimated Crop Budget of Major Vegetables

Crop	Yield /ha	Farmgate Price (R$/unit)	Gross Income (R$/ha)	Production Cost (R$/ha)	Net Income (R$/ha)
Watermelon	3,000fruits	0.1-2.0	1,500	1,930	-430
Cabbage	12 ton	0.1 - 0.8	3,600	2,540	1,060
Green pepper	12 ton	0.5-1.5	6,000	3,800	2,200
Lettuce	62,000 head	0.2-1.0	6,200	2,340	3,860
Leaf Cabbage	22,000 unit	0.1-0.25	4,100	2,670	1,430
Coriander	18,000 unit	0.2-0.8	5,400	3,670	1,730
Spring Onion	18,000 unit	0.2-0.6	3,600	3,120	480
Cucumber	20 ton	0.05-0.8	6,000	4,100	1,900

Source: Recommendable Farming Practices-IDAM, RRA and Farm economic Survey, Farm Interview Survey, Marketing Survey, EMBRAPA

There are great seasonal price variation in the market. The profitability of crops is greatly influenced by the price rather than yields.

(3) Goals of Improving Farm's Economics

The target value set up by IDAM for the vegetable production plan for the State of Amazonas can be a yardstick to indicate the goal for the income improvement plan for the farm whose income comes mainly from vegetables. In this plan, IDAM drew up and proposed the income improvement plan for the farms that produce vegetables in terra firme and varzea. According to the IDAM's improvement plan, it aims to make the profitability in the varzea 3,500 R$/year per 1 ha, and in terra firme where year-round farming is possible, 9,500 R$/year by introducing plastic culture.

Since the vegetable cultivating areas occupied in the average farming areas in the verzea, the current target area, are estimated about 2 ha, the projected profit is assumed to be about 7,000 R$/year. By calculating with the projected figures indicated previously, a rough estimate of the farm's imcome/expenditures will become between 3,200 R$ (175 manpower days of invested labor) and 4,800 R$ (250 manpower days of invested labor) under the present condition. To judge from these figures, the IDAM's target amount of 7,000 R$/year (250 manpower days of invested labor) can be accomplished as the goal of this plan. If the cultivation of aquatic vegetables materializes, the accomplishment of the plan will become greater.

Table 5.7.2-3 shows the major vegetables' price fluctuations in the spot price at farm in a year. The rate of fluctuation is particular large in the prices of water melons, cucumbers, okras, and egg plants.

Table 5.7.2-3 Yearly Fluctuation of Crop Price

Crop	unit	Max. Price	Min. Price	Fluctuation Price (%)
Pumpkin	R$/kg	1.00	0.20	20.0
Lettuce	R$/plant	1.00	0.20	20.0
Sweet poteto	R$/kg	0.50	0.20	40.0
Spring onion	R$/bundle	0.60	0.20	33.3
Codiander	R$/bundle	0.80	0.20	25.0
Leaf cabbage	R$/pieces	0.25	0.10	40.0
Long bean	R$/bundle	8.00	3.00	37.5
Watermelon	R$/plant	2.00	0.10	5.0
Cucumber	R$/kg	0.80	0.05	6.3
Green pepper	R$/kg	1.50	0.50	33.3
Okra	R$/kg	2.00	0.10	5.0
Cabbage	R$/kg	0.80	0.10	12.5
Tomato	R$/kg	1.00	0.15	15.0
Egg Plant	R$/kg	1.20	0.10	8.3

Source: Market Survey by JICA Study Team, Cost de Iranduba, Jandira (Santo Antonio), 2000

The fluctuation in the other vegetables' price are by no means small. In order to accomplish the improvement on farmer livelihood, the effort to keep the price of agricultural products appropriates is more important than the increase of harvest volume.

When an agricultural improvement plan is made, it is necessary to have a means to limit the influence to the nature rather than to put efforts to increase in supplying investment materials for more harvest volumes and higher quality. For example, great effects can be expected by taking such measures like educating farmers on farming management, reducing cost by organization, and reviewing distribution systems. The plan should aim for energy saving development where large outcome can be expected by small investment since it is essential to accomplish its goal by reducing unnecessary supply of cost and stabilizing price.

5.7.3 Tropical Fruits

(1) General Considerations

Income of farmers of Itacoatiara comes from three main sources: agricultural income, non-agricultural sources and extractivism. According to the RRA report, for a sample of 90 farmers on 3 communities, average of total income is R$ 7,935.28 per household of these R$ 4,335 (54.6%), comes from agriculture. The average income of each community is summarized in Table 5.7.3-1.

Table 5.7.3-1 Average Income of the Selected Communities.

Item	S.Antonio	S.Coração	S.J.Araça	Mean
Sample	30	30	30	
Total	6,393.27	13,453.83	3,958.73	7,935.28
Agriculture	2,336.87	8,448.33	2,219.80	4,335.00
Other	4,056.40	5,005.50	1,738.93	3,600.28

Source: RRA and Questionnaire Survey by JICA Study Team, 2000

From IDAM sources, target crop for the Itacoatiara area, are distributed as follows: 700 cupuaçu producers on 1,900 ha with a mean area of 2.7 ha; 260 banana producers on 450 has with mean of 1.7 ha; 97 passion fruit producers on 45 ha with a mean of 0.46 ha.

The most planted crop is cassava with 1,800 producers on 5,500 ha with a mean of 3 ha per producer. Pineapple is the second most planted fruit crop with 400 producers on 650 ha giving a mean of 1.6 has per producer. Pupunha is also a popular fruit. The

above number indicate that most of farmers cultivate cassava for own consumption and to do some exchange with other farmers, they consume extractive products for consumption and some get income from pensions.

(2) Cost of Production and Possible Returns.

To verify the possible income from agriculture, a simple budget analysis was made for target crops. Cupuaçu, the most important target crop of the area, was selected for the analysis. Table 5.7.3-2 show a summary of crop budget for target crops.

Table 5.7.3-2 Crop Budget for Other Target Crops

AÇAI			
Item	Year		
	4	5	6
Cost (R$/yr/ha)	754	754	754
Production (Kg/yr/ha)	6,000	10,000	10,000
Value (R$/yr/ha)	1,800	3,000	3,000
Net return (R$/yr/ha)	1,046	2,246	2,246

IRRIGATED BANANA		
Item	Year	
	1	2
Cost (R$/yr/ha)	5,202	2,188
Prod (Kg/yr/ha)	15,000	30,000
Value (R$/yr/ha)	7,500	15,000
Net return (R$/yr/ha)	2,298	12,812

IRRIGATED MARACUJÁ		
Item	Year	
	1	2
Cost (R$/yr/ha)	3,688	2,085
Production (kg/yr/ha)	15,000	30,000
Value (R$/yr/ha)	15,000	15,000
Net return (R$/yr/ha)	11,312	12,915

MARACUJÁ VARZEA		
Item	Year	
	1	2
Cost (R$/yr/ha)	1,698	1,105
Production (Kg/yr/ha)	4,000	20,000
Value (R$/yr/ha)	15,000	15,000
Net return (R$/yr/ha)	13,302	13,895

CUPUAÇU							
Item	YEAR						
	1	2	3	4	5	6	7
Cost (R$/yr/ha)	1170.7	546.9	687.4	887.4	887.4	887.4	887.4
Production (kg/yr/ha)					3,672.0	3,672.0	3,672.0
value (R$/yr/hr)					1468.8	1468.8	1468.8
Net return (R$/yr/ha)	-1170.7	-546.9	-687.4	-887.4	581.4	581.4	581.4

Source: IDAM, 2000

5.7.4 Family Fishing and Aquaculture

Family fishing aiming at self-consumption is wildly carried out among small-scale agriculture farmers in the study area. Degree of fishing activity differs largely by communities that RRA/QS was carried out as shown in Annex 5.7.4-1. For instance in Itacoatiara, most of farmers in Sao Joao located near Lago Miratuba go fishing every day or every other day, while more than 50% of farmers in Santo Antonio and S. Coracao seldom participate in fishing. In general number of fishing days is higher in flood season than in dry season, because generally fishes are difficult to catch during the flood season.

In addition to RRA/QS, a supplemental interview survey was conducted in Iranduba and a part of neighboring municipal Manacapuru in order to understand significance of family fishing and aquaculture in farmer's economy. A total of 34 farmers and

fishermen were investigated during October to November 2000.

Results of the supplemental survey were summarized in Table 5.7.4-1 (for individual data, see Annex 5.7.4-2).

Table 5.7.4-1 Summary of supplemental interview survey on fishery and aquaculture in Iranduba and Manakapuru.

	Income (R$/month)	Agriculture area (ha)	Fish consumption (g/day)	Contribution of own fish catch or aquaculture to fish consumption (%)	No. of fishing days (days/week)		Fish catch (kg/day)	
					Flood season	Dry season	Flood season	Dry season
1. Higher income group (N=9) *1)	2422 (800-6000)	22 (0-46)	256 (57-714)	67 *1) (0-100)	6,5*2) (6-7)	6,5*2) (6-7)	230*2) (120-400)	273*2) (150-400)
2. Small-scale farmers (N=11) *3)	264 (150-500)	34 (2.5-60)	230 (71-500)	57 (0-100)	3,4*4) (0.2-7)	3,0*4) (0.2-7)	4*4) (0.5-10)	12*4) (0.2-30)
3. Fishermen (N=14)	295 (180-500)	4 (0-30)	402 (119-952)	96 (60-100)	5,8 (4-7)	5,7 (3-7)	33 (10-60)	63 (20-80)

Remarks: Upper raw: average, lower raw: range
*1) Higher income group members include fishing boat owners and aquaculture operators.
*2) Average of 4 fishing boat owners
*3) Including 3 families that have barragem (fish pond)
*4) Average of 8 families that go fishing.

(1) Outline of persons interviewed

Income of the small-scale farmers and fishermen's groups discriminated in this supplemental survey ranged between R$150-R$500 per month. They are typical target group of PRONAF, being categorized into Group C. This income level is much lower comparing to that of higher income group, R$ 800-6,000/month or R$ 2,422/month in average (Table 5.7.4-1). Some of the higher income group, however, are also possible to be beneficiary of PRONAF Group D.

Small-scale farmers posses an average 34 ha of agriculture land, while in general fishermen living in Iranduba town have only small area for agriculture (average: 4.4 ha). Out of 14 fishermen interviewed, 8 persons have no agriculture land.

Per capita fish consumption is calculated as 256 g/day for the families of higher income group, 230 g/day for small-scale farmers, and 402 g/day for fishermen. Although sample number is not sufficient, the results agree with those of previous other studies as reviewed in Section 5.6.6.

(2) Family fishing as a source of livelihood in small-scale farmers

Activity of family fishing or subsistent fishing is different by farmers interviewed. Roughly speaking, about 50% of small-scale agriculture farmers (except for those having barragem) go fishing regularly mainly for self-consumption, while other 50% buy fishes not only from retailers but also directly from other farmers or fishermen.

When average retail price of fish is set for R$ 1.5/kg, average per capita fish consumption of small-scale farmers in terra firme is 230g/day, and average number of family is 4.3 persons, value of family fishing is calculated as follows:

230g/day/person x 365 day x 4.3 persons x R$ 1.5/kg = R$ 541/year/family

or R$ 45/month/family

Considering average income of small-scale farmers is R$ 264/month, the above value corresponds to 17% of the income. This is an approximate extent of contribution of family fishing to farm economy when family members catch fishes by themselves.

In the case of family living in várzea around lakes or in islands, per capita fish consumption is known to be higher. For example, Batista et al. (1998) estimated 550 g/day. This is equivalent to 200 kg/year/person and the highest in the world. In these communities like Paciencia Island of Iranduba, family fishing is one of the most important livelihood. When the above equation is applied, value of family fishing is calculated to be R$ 108/month/family that corresponds to 41% of income.

(3) Contribution of existing aquaculture activity to farmer's livelihood

Results of interview about various aquaculture activities in Iranduba-Manacapuru area are shown in Annex 5.7.4-3, and summarized in Tables 5.7.4-2 and 5.7.4-3.

In all the three small-scale operators who have one barragem each less than 0.5 ha, aquaculture means a source of fish for their own consumption and its contribution to farm income is usually less than 20% (Table 5.7.4-2). Aquaculture is a supplemental minor income source for them. Some of them introduced tambaqui fry from the IDAM Balbina Hatchery, but often failed grow-out of fish, due to lack of technology and/or shortage of operation cost.

Table 5.7.4-2 Contribution of present aquaculture activity to farmer's livelihood in Iranduba-Manacapuru area

Type of operation	Contribution of aquaculture to income or revenue			
	0 % (Self-consumption)	< 20 % (Supplement--al income)	20 - 50 % (Core job)	50 % < (Major job)
Family-base				
Small-scale fish farmers	○	○	-	-
Medium-large scale fish farmers	○	○	○	○
Enterprise	-	-	-	○

Remarks: ○ : found, - : not found

On the other hand, there are several medium-scale fish farms in which fish culture is considered as a core job or major job. They have invested around R$ 30,000-100,000 for construction of facilities, namely baraggem or some earthen ponds of a total of 2-10 ha (Table 5.7.4-3). However, their productivity seems to vary largely due to the technology and management ability of farms.

Table 5.7.4-3 Review of aquaculture activity by different types of operation found in Iranduba-Manacapuru area.

Type of operation / Subjects	Small-scale fish farmers (self-consumption and supplemental income)	Medium-large scale fish farmers (core or major job)	Enterprise (major job)
Income level	R$ 150-500/month	R$ 500-3,000/month	not available
Scale of initial investment	R$ 2,000-5,000	R$ 30,000-100,000	US$ 2.5 million (in plan)
Fish farming facilities and area	Baraggem less than 1ha	Baraggem and/or earthen pond, 2-10 ha	Net cages (0.2 ha at present) *1)
Fish species cultured	Assorted fish species *2)	Mainly tambaqui, followed by jaraqui, curimata, matrinchã, etc.	Pirarucu
Procurement of seeds	Collected from wild and/or purchased	Mainly purchased	Produced in captivity or collected from wild
Feeding	No or supplementally feeding	Routine feeding	Routine feeding with nutritional and medical control
No. of employee for aquaculture operation	0	0 or some	Morethan 10
Harvest	frequently for daily consumption	due to fish growth	due to fish growth
Processing	No	No	Yes (in plan)

Remarks
*1) Scale of net cages are going to expand, and large-scale pond development is also planned.
*2) Tambaqui, jaraqui, matrinchã, curimata, tucunare, acara-acu, caras, etc.

(4) Intention to aquaculture

Among 6 small-scale farmers having potential area for aquaculture development, 5 farmers show interest on aquaculture, and at the same time all the 5 farmers pointed out deficit of budget to start aquaculture. Remaining one farmer expressed negative or risky financial feasibility on practical aquaculture. They understand necessity of relatively high initial investment for construction of facility, and continuous operation cost thereafter.

There are significant numbers of fishermen who reveal interest on aquaculture. However, since most of them do not have potential area, it seems difficult for them to undertake aquaculture under the present circumstance.

In general, small-scale farmers and fishermen show high interest on aquaculture as a new potential livelihood or source of fishes for consumption. However, their knowledge on fish farming technique and fish farm management is very limited.

5.8 Farmers' Organization and Institutional Aspects

5.8.1 Famers' Organization and others in Communities

This section will focus on existing conditions of organizations that assist with production, processing, distribution and marketing of produce of local farmers, or farmer organizations. After a brief introduction which explains the characteristics of informal and formal farmer organizations in the Amazon, a more detailed discussion of the existing organization and management conditions is provided in the three municipalities of Iranduba, Itacoatiara, and Maues. Information was obtained through

personal and group interviews with farmer organizations, the Report of the RRA and Questionnaire Survey, IDAM Operation Plans, and Municipality secondary data. Field interviews were held in five communities in Iranduba: Jandira, Sao Jose/Ilha de Jaracutu, Sao Francisco, Divino Espirito, and Sao Sebastiao. Information on Itacoatiara farmer organizations comes also from field interviews in Sao Pedro/Colonia Rondon and Sao Joao de Araca. Maues field interviews were held in Ponta Alegre and Nossa Senhora de Nazare.

Most farmers in the three municipalities form informal organizations. They are based on labor exchange for productive activities or collective action for specific community based activities. Many of these relationships are based on neighbor producer relations, religious relationships, or informal networks established in the community for a variety of reasons. Formal farmer organizations include producer organizations, community farm associations, and cooperatives. Marketing cooperatives are considered the most complex farmer organizations that give farmers greater control and ownership of the marketing of their produce. Mutual Fund cooperatives provide farmers greater ownership of their savings.

Table 5.8.1-1 Types of Farmer Organizations and Community-based Organizations located in Iranduba, Itacoatiara, and Maues Municipalities: 2000 (1/2)

Type of Organization	Characteristics of Organization
Informal Producer Groups (ajuri, puxurim, mutirao)	Unpaid labor groups mainly for land clearing/preparation; may be used at weeding, pruning, water carrying, harvest, but rarely used. "Group of Five" exchange groups being revitalized where daily rotation of 5 persons for 5 days of week, individual farm work on Saturday, rest on Sunday is the pattern of organization. Neighbor groups working together on similar productive activity
Informal Rotating Credit and Savings Associations (consortio)	Usually group of individuals who contribute money each month and one person receives the full monthly contribution of all members. This not found in the municipalities. Monthly savings by members of an association to buy patrimony found in Sagrado Coracao de Jesus, Primavera, Sao Joao de Araca (all Itacoatiara)
Unregistered community organizations	Community organization formed under CEB program of catholic church with president, catechist as social mobilizer; protestant nucleated settlement religious congregation with local member acting as leader. Activities are productive, social, religious, and often include organizing community celebrations, such as local saint's days. Can be used as a focal group for organizing informal producer groups. Community organization in Maues are based on physical structure of church; emerging whole protestant communities and organizations now in Itacoatiara
Farmer Organization Informal Networks Conselho de Desenvolvimento Comunitario (river community networks), Associacoes de Ribeirinhos (river dwellers associations) Farm Women's Movement Network	More than one registered or unregistered community organization, or combination who informally organize to accomplish a specific activity (e.g. a school boat) like Conselho de Desenvolvimento Comunitario Nossa Senhora de Lourdes (N.S. de Lourdes Community Development Council), Conselho de Desenvolvimento Comunitario Bom Jesus de Canela (Bom Jesus-Canela Community Development Council (Maues); Associacoes de Ribeirinhos (river-dweller associations) hold meetings to discuss environmental, social, productive issues of a common ecological area (Iranduba, Itacoatiara, Maues); farm women's movement networks organized at present with Catholic church assistance (Arary River, Itacoatiara)

Table 5.8.1-1 Types of Farmer Organizations and Community-based Organizations located in Iranduba, Itacoatiara, and Maues Municipalities: 2000 (2/2)

Type of Organization	Characteristics of Organization
Local NGOs	Most local NGOs are urban-based welfare, sports, or retired associations. APAE-Itacoatiara, Centro Comunitario de Iranduba; ASTRI (Association of Rural Employees from Iranduba), Grupo da Paz (sports association-Iranduba); Sociedade Pestalozzi de Maues. Amerinda, an international NGO with a local Maues office, has participatory designed programs working with 30 Sautere or indigenous communities, esp. in health care in Maues. Woodworkers Associations (Itacoatiara, Maues) include extractivist & furniture makers. They have activities in timber tree nursery production with members and local farmers
Farmer Cooperatives at State/local level	SESCOOP/AM (Servicio National de Aprendizagem do Cooperativismo/AM is the state branch of SESCOOP and provides training to cooperatives for IDAM; ASCOPE is a highly successful village based cooperative (Itacoatiara); Cooperativa Agricola de Maues (Maues Agricultural Cooperative) is of uncertain repute
Producers/Fishing Associations	Single type crop, livestock, fishing associations registered under Societies Act. Sol Nascent (Rising Sun)of Japanese Colonists and APIR input & marketing association of large farmers (Iranduba) Colonias de Pescadores (fishing associations) in all areas; sugarcane producer associations (Itacoatiara), Beef and Cattle Raisers Association (Maues)
Sindicatos de Trabalhadores Rurais-STRs (Rural Workers' Unions)	Organize farmer organization training programs, manage pension funds, mobilize rural women to register as rural laborers;
Mothers Clubs, Rural Women Producer Groups	Mothers clubs focus on skills training of male and female youth, maternal child health and nutrition, avoiding young girl pregnancy. Are promoted under a Catholic NGO program and are subprojects of fishing associations (strong in Maues). Rural Women Producer Groups found in Iranduba and initiated by IDAM to train women in medicinal plant production, processing, skills training in cottage industries, esp. handicrafts, sewing, food processing
Youth Clubs/Solidarity Groups	Youth clubs are urban-based but rural youth attending urban schools can belong;; Agente Jovem Desenvoluimento Social E Human (Young Development Agent) federal program for urban youth to build solidarity groups, become young citizen mobilizers initiated in Iranduba in 2000
Community Farmer Associations	Community based organizations registered under the Societies Act. Usually, but not necessarily, geographically based depending on how formed.—e.g. if formed from a community organization first organized by a congregation whose members live on islands and along rivers but go to same church (Iranduba, Itacoatiara, Maues); members could be mixed community and nucleated settlers of a geographic specific area (esp. in Maues) ; geographically based

The following provides a more detailed description of the main activities of 11 existing types of community-based organizations found in the three municipalities.

(1) Informal Producer Groups

Traditional rural producer work groups, called *ajuri, puxurim and mutirao*, are joint labor groups of extended family and /or neighbors for a particular member of their community or for a common group activity. In some communities a traditional "group of five" organization is practiced or being revived, whereby there is daily rotation to each group member's land from Monday to Friday, individual labor on Saturday, and rest on Sunday. Producer group based on the "group of five" system is used mainly for land preparation. Family members or paid labor perform required labor at pruning, weeding and during harvest season. In the case of guarana

production, pruning and weeding, farmers report limited income to pay laborers at these stages and constraints on family labor due to conflicting labor demand for food productive or processing activities, such as fishing, hunting, and farinha processing.

(2) Informal Rotating Credit and Savings Associations

Unlike rural poor families in other countries of Africa and South Asia or in urban areas of Brazil, farmers did not state any active *consortio* or informal rotating credit and savings associations during field interviews in 9 farmer organizations and with 10 women. This may be due to the lack of trust among community members, high risks of income insecurity from single season agricultural production, or interviews mainly with male dominated farmer organizations. Worldwide, poor women traditionally operate informal savings and rotating credit associations or groups. Moreover, in Iranduba and Maues field interviews, no one stated that they individually save sufficient money to pay labor at needed times of the agricultural cycle. Three communities reported using savings scheme in Itacoatiara: Sagrado Coracao de Jesus, Primavera, and Sao Joao de Araca. However, each scheme was related to formal activities of maintaining or acquiring patrimony for their formal organization, not improving farmer household savings capacity of community members.

(3) Unregistered Community Organizations

A non- inclusive form of community organization is the informal community organization. These community-based organizations are made up of farmers and usually organized around a church congregation to engage in initiate collective activities on behalf of its members. In Maues and Itacoatiara the Catholic Church historically organized community organizations. In Maues a rural settlement with the physical structure of a church is defined as a community.

Not all members of a church congregation are members of a community organization. Traditionally all members of a community organization are members of the same congregation, regardless of whether they live in the physical location of the settlement or on distant islands. This type of farmer community organization has an elected president and a mobilizer, the church catechist. In the absence of a formal registered community association, the president acts as contact person for public relations or services with government agencies or NGOs.

Protestant farmers living in nucleated settlements or away from the “main” community location may become members of the community organization. They usually have their own informal community organizations equivalent to their church congregation. For example, in Sao Pedro/Colonia Rondon, in 1999 there were 35 families, 7 protestant churches each with a community organization, and a registered community farmer association. The formal community farmer association acts as an

independent organization, not a network or umbrella organization for the other community organizations. Increased in-migration of protestants and conversions to Protestantism has led to an increase in nucleated settlements, establishment of settlements based on religion, and inactive settlements due to abandonment of communities based on religious conflicts or lack of social cohesion among community members. For example, in Itacoatiara, new communities have emerged with the same name (e.g. Sao Jose I and Sao Jose II), 14 communities in 1999 were reported inactive (e.g. Assembly of God and Galilee), new settlements have emerged (e.g. New Jerusalem and Valley of Paradise.)[1]

The Catholic Church Basic Christian Communities (CEBs) program initiated the formation of community organizations with some formal structure starting from the early 1960's. In Itacoatiara and Maues their activity was greatest during the 1970's and 1980's when there was a high influx of migrants for work on highway and extractive industry development activities. The program focused on helping new settlement communities and traditional riverine communities receive resource-poor migrants who had no kin or limited common bonds with other residents, except being catholic. Catechists were trained in conscientization skills, such as demanding fair wages from companies and organizing to access municipal services, and training in organization skills, such as how to conduct a meeting and elect a president.[2] The CEB program goal was to build trust and a cooperative spirit among old and new members by recognizing the benefits of collective action.

The Catholic Church now operates another program, called Movimento de Educacao de Base (MEB). This program further trains catechists in organizational procedures, gender conscientization skills, and organizing women's rural networks to raise consciousness of women to their pension rights as rural laborers, right to become a community leader, and right to have equal say in decisions regarding use of scarce family resources. In Itacoatiara, the successful ASCOPE cooperative and Sao Joao de Araca associations initially were founded on the community organization initiated under the CEB movement and now actively participate in the MEB program.

When EMATER, the predecessor of IDAM, initiated a program to encourage settled areas to form community farmer associations by registering as legal entities, many CEB formed community organization registered themselves as community [farmer] associations. Under present conditions, community farmer associations may or may not have catholic or protestant members and members may reside in nucleated or "community" settlements. In some cases, Protestants do not join a community farmer

[1] IDAM. Municipality community data from the Ministry of Interior, 1999.

[2] As in the community of Santa Rita (Itacoatiara), migrants were provided land use rights from INCRA, and were organized by SUDAM into settlements of around 58 families with an average 50 ha per family in an area accessible by dirt road. Few settlers had any kin or community bonds, except many came from the Northeast, with the other settlers. Program Nacional de Microbacias Hidrograficas. Project de Desenvolvimento Comunitario da Comunidade de "Santa Rita", Municipio de Itacoatiara, Amazonas, 1998, p. 8.

association due to the church background of the members, but will engage in their activities. For example, in Sao Joao de Araca community association, protestant farmers refuse to be members but pay for use of the association boat, undertake joint land preparation activities, and perform paid labor for association members. A symbiotic relationship usually does not exist according to IDAM/Itacoatiara staff. The extent to which religion mobilizes or deters cooperation in community farmer associations is not known in the three municipalities and requires diagnostic study.

(4) Farmer Organization Informal Networks

Community organizations have also organized informal networks to accomplish specific activities, such as collective use of a produce boat, operation of a school transport boat for villages in which children all go to the same school, or joint use of a community health post. River Networks assisted with IDAM in Maues include the Conselho de Desenvolvimento Comunitario Nossa Senhora de Lourdes (N.S. de Lourdes Community Development Council) and the Conselho de Desenvolvimento Comunitario Bom Jesus de Canela (Bom Jesus-Canela Community Development Council.). Neither network has specific activities related to production, marketing, or processing of agricultural products, nor are they legally registered associations; however, they have a potential for engaging in such collective activities with appropriate training.

(5) Local Non-governmental Organizations (NGOs)

Municipality based NGOs were not found relevant to working on activities to strengthen farmer organizations. Only three municipality based NGO s were registered with the Department of Social Welfare of the State Secretary of State for Workers and Social Welfare (SETRAB) [3] They are Centro Communitario de Iranduba, APAE (Itacoatiara), and Sociedade Pestalozzi de Maues. Others noted in Iranduba are ASTRI (Association of Rural Employees from Iranduba), Grupo da Paz (sports association-Iranduba. Each is town based, welfare or sports club focused, and not relevant as NGOs who could assist strengthening farmer organizations. Amerinda is a Spanish NGO located in Maues that works exclusively with the 30 Sautere (indigenous) communities. While they engage in mobilizing skills and use participatory methodologies, their mandate is to serve these communities only. Woodworkers Associations are organized by extractivist and are located in Itacoatiara and Maues communities. In Itacoatiara, they have set up tree nurseries for timber trees with members and local farmers.

(6) Farmer Cooperatives

Cooperatives were first organized in the Amazon in Manaus in the 1950's and rural

[3] Govt. of the State of the Amazon. Secretary of State of Workers and Social Welfare (SETRAB). List of NGOs with Formal Agreements with SEWTRAB. November 2000.

cooperatives first formed in the 1960's. Rural cooperatives were formed for specific activities, notably jute, malva, and processing of wood. During the 1970's and 1980's, jute and malva cooperatives were consolidated. Housing cooperative societies, mutual credit societies, and professional cooperatives (such as taxi cooperatives) were introduced. At the present time, there are 49 rural cooperatives with 8, 125 cooperators (members), 461 employees, with 35 still functioning. Of these, 18 are registered as agricultural cooperatives in 15 municipalities, with 1075 cooperators (members) and 75 employees. Only 4 agricultural cooperatives are functioning.[4] ASCOPE, farmers' cooperative established in 1994 in Sagrado Coracao de Jesus of Itacoatiara Municipality is considered the most successful farmers cooperative in the State and has 80 cooperators.[5] The less reputed Agricultural Cooperative of Maues has 80 cooperators. The largest cooperative society in the Amazon is the Manaus based Mutual Credit Cooperative, with 8,000 members.

(7) Producers Associations

Producers Associations are registered under the Societies Act. They include members of different communities who grow or market the same particular farm commodity. In Iranduba, two producer associations have members with incomes above the target group of beneficiaries. Once is called Rising Sun (*Sol Nascent*) with 26 small farmer members and formed by Japanese colonists. The second is APIR that buys inputs wholesale for it members and assists its members with marketing. In Itacoatiara, two sugar cane associations were noted; in Maues, a Beef and Cattle Raisers Association have been formed. Producer associations focused on meeting the marketing or credit needs of subsistence or near subsistence farmers producing similar cash crops were not found.

(8) Rural Labor Unions

STRs are rural labor unions or syndicates at local level. Rural labor unions advocate what they politically believe are the best strategies to reduce farmer exploitative circumstances. These include: promotion of farmers guaranteed markets, integrated cropping to decrease farmer risks of crop failure, and unions to overcome middlemen exploitation. They mobilize women to become members as rural laborers to secure pensions for them otherwise unavailable to them as housewives.

Rural unions were once active in Itacoatiara Municipality and especially in settlement schemes, like Colonia Rondon, and in Iranduba Municipality when it was still under the jurisdiction of Manaus. They have been active in Sagrado Coracao de Jesus, the most organized community in the study areas since 1987. In Maues, rural labor unions (STRs) are present in 37 rural communities, with 34 of them presently

[4] SESCOOP/AM. Plano de Trabalho (Work Plan), 2000, p.4.
[5] IDAM Association Dept documentation. See also marketing section. Report of Rapid Rural Appraisal and Questionnaire Survey, p. III-19.

active with 5,525 members. Of these, about 1,300 are active members.

(9) Mothers Club and Rural Woman Producer Groups

Women producer groups are informal groups of women who organized to do collective activities in home industries; preparation of medicinal plants, processing of extractive fruits and nuts from forest areas, handicrafts, and home based enterprise marketing. In three years, four women's groups have been formed in Iranduba (each with 20 members). IDAM/ Maues assisted three Mothers Clubs, and none reported in Itacoatiara. Mothers Clubs in Maues are active in helping youth learn skills for employment, setting up nutrition programs and feeding programs for malnourished children, and providing young women skills to be employed, go to school and prevent early pregnancies. The Mothers Club program is subprogram of fishing associations as well as an active program of the Catholic Church NGO maternal child health and nutrition program of the archdiocese. Women Producer groups are not associated with community farmer associations but are a separate program. In Iranduba all are located in *terra firme* areas, not in vareza land areas.

(10) Youth Clubs/Solidarity Groups

Several urban social welfare programs form youth clubs but youth from rural communities who attend urban schools can get involved. Emphasis is to decrease youth labor in manioc cultivation, keep youth (especially rural youth) in school, and build citizen responsibility. Federal program called Agente Jovem Desenvoluimento Social E Human (Youth Development Agent) is urban based, and initiated in Iranduba in 2000 with 25 scholarships for youth between 14-17 years. Purpose is to motivate local talent to continue their schooling, be trained how to organize solidarity groups, improve youth health care, build youth to youth relations on drug free basis. Program is now urban based due to scarcity of funds for rural youth, but could be expanded into forming youth groups/clubs on a matching private sector donation or other donations, according to Secretary of Social Welfare.

(11) Community Farmer Associations

The organization of farmers into community farmer associations in the State of the Amazon was started by EMATER, the predecessor of IDAM. The purpose was to enable communities to access grants in kind from the Municipality under various programs.

Basic Requirements of Community Farmer Association include meeting legal requirements under the Societies Act. To be legally registered a community group must have held a general assembly and have had the Statutes or Articles of Association for the organization approved by vote. The statutory requirements include:

- Name and clearly identified purposes for creation

- Defined conditions for membership, including duties and responsibilities;
- Identification of how they can financially sustain themselves;
- Defined management structure (general assembly, administrative council, executive or president);
- Plan for dissolution of organization.

5.8.2 Number of Famer Organizations Focused on Agricultural Development Activities

The number of informal producer groups, unregistered community organizations and registered community farm associations varies by reference source, date, and identification criteria. As a result, estimates are made to determine the extent of communities likely to have community organizations (registered and unregistered), and number of producer groups. More information is needed on the extent and types of producer groups and community organizations engaged in productive activities in each municipality.

Table 5.8.2-1 Estimated Number of Registered and Unregistered Farmer Organizations by Municipality: 2000

Registration Estimates	Iranduba	Itacoatiara	Maues
No. of communities*	82	218	127 or 99
No. formal agricultural associations**	32 with 1,784 members	93	12 or 19
PRONAF/FNO data***	18	93	38
No. informal producer groups****	13 with 358 members	Est.174 with 1,116 members	Est. 102 with 408 members

Sources: IDAM, Municipal Plan for Rural Development: 1996-1999; ICOTI: Basic Information on Municipality of Itacoatiara, 1996; ICOTI Basic Information on Municipality of Maues, 1996; IDAM, Community Data from Ministry of Interior, May, 1999; IDAM Itacoatiara Operational Plan 2000; IDAM Maues Operational Plan 2000; IDAM Data on Rural Communities that received Agricultural Equipment and Implements under III Ciclo Project Data; IDAM Itacoatiara, Ag technician association responsibility list in 1999.

*Iranduba communities identified in 1996-1999 MPDR; Itacoatiara communities identified by 1999 IDAM/Ministry of Interior Data; Maues III Ciclo data indicate 212 organized communities and nucleated settlements; ICOTI (1996) indicates 127 organized communities; and 1996-1999 MPDR indicates 99

** Iranduba, MPDR; ICOTI (1996) FNO reports; IDAM/Itacoatiara Office indicates 93 community organizations, with 39 actively assisted in 1999 in terra firm settlements, 2 producers associations, and some located in 6 vareza locations. IDAM/ Maues (1999) reported 12 community farm associations, including one producer association.

*** IDAM/Maues Operation Plan2000 indicates 19 associations to be assisted, of which only 3 are the same as in IDAM/Maues Operation Plan1999, or a potential total of 28 communities having an organized community association under PRONAF; however official PRONAF 2000 documents reports 38 communities. The latter data are to be confirmed. IDAM Head Office official data are used for reporting.

****Iranduba 1996-1999 MPDR; Itacoatiara estimates assume 80% of 218 communities, average size community 32 families, or 6.4 producer groups/community. Estimate is based on 127 organized communities, average size community 20 families, 4 producer groups/community.

(1) Estimated Number of Informal Producer Groups

Producers groups are essential for land clearing and preparation, whether after flooding in vareza areas or during clearing forest for manioc and tropical fruit production under traditional shifting cultivation techniques of production. The MRDR for Iranduba identified the number of informal agricultural associations as 32 without indicating criteria. In Maues and Itacoatiara, due to dominant use of shifting cultivation practices by subsistence farmers, it is assumed at least 80% of organized or nucleated settlements of subsistence farmers have at least one informal producer exchange group of 5 persons for every 5 families. To prepare estimates, in Maues the

average settlement size of 20 families (III Ciclo Data) and 127 organized communities (ICOTI, 1996) was used; in Itacoatiara, an average settlement size of 32 families and 218 communities (IDAM/Ministry of Interior, 1999). The number of informal producer groups is estimated at 408 in Maues and 1116 in Itacoatiara. Using III Ciclo data on number of communities and nucleated settlements (228) in Maues, the potential number of informal producer groups could be as high as 678.

(2) Estimated Number of Community Farmer Associations

As noted above, the number of communities varies by data source. Not all organized communities have registered associations. They could have informal community organizations organized by religious congregations. One condition of a farmer obtaining access to PRONAF and FNO credit, however, is that he/she is a member of a [registered] association. PRONAF 2000 monitoring reports indicate for Iranduba, 82 communities and 18 communities of 5,790 families receiving PRONAF services. In Maues, 99 communities and 38 communities of 9010 families are reported as receiving PRONAF services. This means only 20% of Iranduba communities and 38% of Maues communities to data have registered associations under the municipality development program.[6] In Itacoatiara, ICOTI reports 93 communities received either FNO-special or FNO-standard credit lines, or 43% of known communities. The estimated minimal number of formal community farmer associations in the three municipalities is thus 18 in Iranduba, 93 in Itacoatiara, and 38 in Maues.

(3) Potential and Existing Farmer Organizations by Municipality

IDAM provides both direct and indirect assistance to a wide range of local organizations through its Association Development program. General assistance means they have met at least once with the community within four years and direct assistance means that they have visited the community at least 2 times/year for Iranduba and Itacoatiara Offices and 3 times/year for the Maues Office. The following indicates the number of existing and potential communities with registered associations.

a) Iranduba Municipality

According to the Secretary of Production, about 65 out of 150 community associations are active in Iranduba ("the rest are paper only"). All associations must be registered and approved by the CMDR, whose current membership includes 62 community associations. IDAM/Iranduba reported assisting 11 registered community farmer associations in 1999 and 18 by 2000 (PRONAF data). Island based community associations are serviced by boat. Dirt roads off the Amazon Highway

[6] SEE/COPLAN-IDAM 2000. Beneficiaries of PRONAF of the State of Amazon, Second Work Plan 2000 and Access to Rural Credit, 2000.

connect many terra firme communities and Costa do Caldeirao communities. Costa de Iranduba communities are accessible in the dry season by dirt road. All vareza communities are isolated during the flood season with limited accessibility by boat.

The municipality is divided into development regions of the Rio Negro and Solimoes River. Along the Solimoes River vareza farming systems exist. There are 21 organized communities listed with the Municipality Department of Social Welfare in this pole. It is not known how many have registered associations; 5 registered associations participated in RRA activities from the Costa do Iranduba, Ihla de Jaracutu, and Costa do Caldeirao.

Table 5.8.2-2 Location of Potential Community Organizations along the Solimoes River

Location	Name of Community
Costa do Irranduba	Divino Espirito Santo, Sao Francisco, Sao Joao
Ihla do Baiscio	Renascer, Santa Luzia
7 de setembro	7 de setembro
Maria Antonia	Maria Antonia
Marchantaria	Sao Francisco, Santa Luzia, Sao Lazaro I, Sao Lazaro II, Sao Jose, Sao Sebastiao
Ihla de Jacurutu	Sao Francisco, Sao Jose
Muratu	Muratu
Ihla de Paciencia	Sao Joao Batista, Nossa Senhora de Fatima, Nossa Senhora da Conceicao
Costa do Caldeirao	Jandira
Caldeirao	Sao Joao, others not eligible –Empraba, Vila Cavalcante
Total	21

Source: Iranduba Municipality Dept of Social Welfare, 2000.

b) Itacoatiara Municipality

According to IDAM/Ministry of Interior, there are 218 communities in Itacoatiara in 1999. IDAM Field Office reports knowledge of 122, that is, a technician has visited the community within the last 4 years. ICOTI (1996) FNO credit reports indicate 93 of these 122 have registered community farmer associations.

A summary of communities by growth pole in Itacoatiara is provided below and based on Ministry of Interior official lists of communities.

Table 5.8.2-3 Number of Communities by Pole and Location:Itacoatiara, 1999

Pole		No.of Communities
Pole I:	Prana da Eva, Rio Preto da Eva, Lago do Acuma	31
Pole II:	Novo Remanso, Ilha da Maquira, Costa da Conceicao	21
Pole III:	Igarape do Carao, Parana do Serpa, Costa do Tabocal	24
Pole IV:	Rio Arau, Rio Arary, Iratazinho-Arary, Lago Preto	56
Pole V:	Rio Urubu, Taboca, Copaiba	59
Pole VI:	Costa do Surubim, Ilha Beija Flor, Costa do Cumaru	27
	Total	218

Source: IDAM, May 1999

In 1999, 39 community farmer associations were included in the operational plan of the 11 IDAM and municipality-appointed technicians. Community organizations were not identified in vareza locations served by 2 technicians. The location of assisted community organizations is mainly along the Arary River (15), and off secondary roads from AM-010 (16). The former is accessible by boat and the later by

dirt roads often impassable during the rainy season.

IDAM/ Itacoatiara association activities have been constrained by limited availability of funds, broken boats, irregular salaries for municipality paid technicians, and a focus on FNO credit recovery activities. Only 39 associations were known to have received general assistance in 1999

Table 5.8.2-4 Name and Location of Associations/Communities Assisted by IDAM: 1999

Location	Association/Communities	Location	Association/Communities
AM-010-URUBU-Lago de Serpa	Sagrado Coracao	Arary-Col do Itaubal	Itaubal
Col do Piquia	Sao Jose	Vila Batista	N.S. Perpetuao Socorro
Col. Rondon	Sao Pedro	Rio Arary	Sao Joao do Araca
Col Rondon	Santo Antonio-1	Itapaiuna	Sao Francisco
Sangaua	Santa Antonio	Stanislau	Livramento
Estrada da Sudam	Santa Rita	Lago do Moura	Sao Sebastiao
Urubu	Santa Maria Do Taboca	Rio Arary	Monte Cristo
Urubu	Unidos do Cana	Igarape do Pahi	Sao Francisco do Pahi
Urubu	Sao Jose das Pedra	Chocolateira	Sao Lazaro
Costa do Quele	Nova Jerusalem	Arary	Monte das Oliveiras
Mirapucuzinho	Irmaos Unidos	Parana do Uraria	Menino Deus
AM-010	Sao Francisco	Arary	Santa Rosa
Ramal Nova Vida	Nova Vida	Arary	Shalon
AM-010	Visconde de Maua	Igarape do Pombo	Pombo
AM-010	Bom Jesus	Parana Curupirinha	Primavera
AM-010	Sao Raimundo		
Ciazonia-Iracema	Sao Pedro		
Costa do Amatary	Sao Jose		
Vila Novo Remanso	Novo Remanso		
Igarape do Parica	Parica		
Parana do Jacare	Sao Francisco		
Lago do Engenho	Sagrado Coracao		
Rio Presto de Eva	Sao Joao		
Aruma	Sao Sebastiao		
Varzea Urucuttittuba	No specific ones identified		
Costa da Conceicao	No specific ones identified		
Ihla do Cumaru	No specific ones identified		
Costa do Arapapa	No specific ones identified		
Costa do Surubim	No specific ones identified		
Ilha do Risco	No specific ones identified		
Itacoatiara-Cattle Raising	No specific ones identified	**Total**	**39 known assisted, 93**

Source: IDAM Itacoatiara Office, June 1999

It is estimated that 17.9% of the 218 communities of Itacoatiara having potential community organizations and 41.9% of registered community farmer associations involved in the FNO credit program now received IDAM general assistance in 1999. The potential in Itacoatiara Municipality for forming and strengthening community farmer associations is thus enormous.

c) Maués Municipality

In Maues Municipality the number of communities, nucleated settlements, and "places (Lugars) is 228 in 1999. This includes 191 communities and 37 nucleated settlements (33, if places or *Lugars* are excluded). Some of these communities are part of the two river councils or have community organizations and mother's clubs set up under the CEB and MEB programs. A summary by regional growth pole is provided below. As is evident, there is enormous potential for the formation and

strengthening of registered community farmer associations in this municipality.

Table 5.8.2-5 Number of Rural Communities and Nucleated Settlements by Development Pole: Maues, 1999

	Pole Name	Community	Nucleated Settlement	Total
I.	Maues Acu River	5	2	7
II.	Limao Grande River	8	0	8
III.	Punhal River	7	4	11
IV.	Maues Acu River*	11	4	15
V.	Parauari River	15	2	17
VI.	Urupadi River	11	0	11
VII.	Marau River	31	0	31
VIII.	Maues Miri River	16	5	21
IX.	Castanhal de Baizo	11	2	13
X.	Lago Grande de Barreira	10	4	14
XI.	Apocuitaua River	6	1	7
XII.	Apocuitaua Grande River	18	5	23
XIII.	Apocuitaua Grande de Cima River	13	1	14
XIV.	Parana de Uruaria de Cima**	9	5	14
XV.	Parana de Cima	10	2	12
XVI.	Paracuni River	10	0	10
	Total	**191**	**37**	**228**

*does not include Fazenda Repartimento ** includes 4 Lugars and 1 Nucleated Settlement
Source: IDAM/Maues. III Ciclo Community Data. 1999.

IDAM assisted only 11 community farmer associations and 1 producers association under its association development program in 1999. IDAM/Maues focus is mainly to help guarana production by working directly with guarana farmers and assisting them access formal bank credit. One technician is assigned the development of community farmer associations, one the development of the cattle and breeders association, and one is assigned to assist women. The IDAM/Maues office also provides direct and indirect assistance to the two riverine councils or river networks mentioned earlier, fishing associations, and Mothers Club. The farmer specific associations IDAM assisted in 1999 are indicated below. Other associations have been identified in subsequent reports as 19 associations without clarification at what stage of formation is the community farmer association.

Table 5.8.2-6 Name and Type of Associations Assisted by IDAM-Maués: 1999

Type of Organization	Name of Association*
Community Farm Associations	CFA –Liberdade
	CFA-Ponta Alegre
	CFA-Osorio da Fonseca do Rio Paracuni
	CFA-Lago Grande
	CFA-Maués Mirim
	CFA-Castanhal
	CFA-Santo Antonio do Mucaja
	CFA-do Urupadi
	CFA-Menino Deus
	CFA-BomJesus do Pupunhal
	Fatima Village Development Association
Producers Association	Maués Association of Cattle and Buffalo Breeders
Total	12

Source: IDAM-Maués, May 1999
*other 1999 Field Reports provide a different set of associations, and identify 19 associations,see 5.10.

(3) Characteristics of Registered Community Farmer Associations

Providing a community grant or accessibility to credit or services (e.g. health post and agent) through a registered association or to farmers in registered associations is now the major strategy used by municipality governments for the development of rural communities. The Municipal Council of Rural Development (CMDR) in Iranduba and Maues reviews municipality grants to registered associations under the PRONAF program. Farmers eligible for formal bank credit under PRONAF must be members of registered associations. Only farmers belonging to farm associations can apply for formal bank credit under the FNO-special credit line or for group project development under the FNO-standard credit line in Itacoatiara. Under existing municipality development strategies, registering a community farm association enables farmers to access individual farmer credit and access services they need (e.g. truck use for market transport of produce), or as a collective group receive items too expensive for them individually or collectively to purchase (e.g. tractors, haulers). The following describes some of the organization, management and planning characteristics of registered community farmer associations.

a) Organization, Management, and Participatory Aspects of Community Famer Associations

Community farmers associations have statutes of association, a president, secretary and treasurer, and are required to keep record books of meetings and finances, have a contribution fee plan, dissolution plan, and have a general assembly or membership. Members of community farmer organizations are usually men. The president of the community farm association (CFA) maintains contact with municipality officers and IDAM technicians. He/She assists their association receive donations, access services availability to rural communities in health, education, transport and is usually the person to whom politicians first contact for organizing local meetings. They are to organize a council to help the president set policy and meeting agendas, and the president is to be elected during a specified period of time. In all communities of farmer interviews, meeting record books existed, but no financial records were available to review. In field interviews in the Iranduba communities, none had any training in how to conduct a meeting, organize committees, or knowledge of legal obligations of the statutes of association, except in Itacoatiara. Elections of presidents were found in all CFAs, with the duration of president appointment usually found as 2 years and presidents reelected at least twice.

b) Frequency of meeting attendance

About 80% of farmers indicated they sometimes or frequently attend their association meetings according to the RRA questionnaire survey, in which 240 farmers out of 270 responded to this question. Meeting attendance varied by community. About

11% said they are not informed of meetings; 11% said they do not attend meetings. However, nearly 57% stated that they frequently attend meetings. The CFAs with the highest percent of meeting attendance were in Sagrado Coracao de Jesus and Sao Joao de Araca (Itacoatiara). The least frequently attended meetings were noted in the Costa de Iranduba community of Divino Espirito Santo.

Table 5.8.2-7 Frequency of Farmer Attendance at Community Farmer Association Meetings by Municipality and Study Community: 2000

Community	Not Informed of meeting	Frequently	Sometimes	Not attends	Total
Iranduba-Costa	8	5	12	5	30
Jacurutu	2	19	3	6	30
Jandira	5	15	7	3	30
Itacoatiara-S. Antonio	5	16	8	1	30
S. Coracao	2	22	5	1	30
S.J. Araca	1	22	3	4	30
Maues-Mom Jesus	2	18	5	4	29
N.S. Nazare	1	19	9	2	31
P. Alegre	3	19	7	1	30
Total	26	136	52	26	240
Total %	11%	56%	22%	11%	100%

Source: Report of RRA and Questionnaire Survey, Table 92, p. A2-90.

c) Farmer perspectives on management and cooperation in their community farmer associations

Out of 270 farmers interviewed during the RRA, 251 responded to various questions related to member motivation, cooperation, leadership and legal characteristics of their associations. Lack of analytical skills is indicated by percent of farmers who could not provide information about problems in their association. Findings indicate three existing conditions: lack of analytical problems of its members (39%), lack of motivation of the community to work with and in the association (26%), and poor, dominant and irresponsible leadership (22%). Most farmers were not concerned with the legal basis of their organization.

Communities with the largest percent of farmers who could not provide any information were in Itacoatiara (45%). Itacoatiara farmers also indicated highest lack of community motivation (37%) towards participation in association activities. The greatest problem of the associations in Iranduba was poor leadership (44%). Maues communities followed the same pattern of Itacoatiara communities, except they characterized their associations as having irresponsible leadership (7%). More than 16% said there were other issues related to their association management besides leadership, motivation, finance, and lack of women's participation.

Only one Itacoatiara respondent noted lack of women members an issue. This indicates general lack of gender awareness of the strategic and practical needs of both male and female farmers. Legal issues were mentioned by less than 4% of farmers in all areas.

Table 5.8.2-8 Percent of Organization Problems identified by Farmers in RRA Communities by Municipality: 2000

Characteristic of Community Farmer Association	Iranduba %	Itacoatiara %	Maues %	Total %
Did not provide any information on management issues	33	45	39	39
Lack of interest by community	11	37	27	26
Lack of legal basis	1	2	4	3
Lack of leadership	44	7	-	16
Leaders dominate ideas	4	2	4	3
Irresponsible leadership	1	-	7	3
Some do not have money to pay fees	-	4	4	2
Lack of women as members	-	1	-	1
Other issues	6	2	15	8
Total	100%	100%	100%	100%
No. of Respondents	80	87	84	251

Source: Report of RRA and Questionnaire Survey, 2000,

5.8.3 Fishermen's organization

(1) Colonia – municipal level -

Historically, fishermen in Brazil are organized in so-called "fishery colonies" (Colonias de Pescadores). Since colonial times the Brazilian Government has made sporadic attempts to control this professional category. The first "colonies" were founded in 1919 by the military with the primary objective of organizing fishers to contribute to a coastal defense system, rather than to defend their own economic and social interests (Isaac et al., in press).

Like other Brazilian unions, colonias have jurisdictions that correspond to municipal boundaries and named traditionally with Z- numbers. At present colonias function practically as fishermen's cooperative.

(2) FEPESCA/AM/RR - State Level -

In the State of Amazonas, organization of fishermen was started in 1967. As an upper organization of colonias, a fishery federation in the States of Amazonas and Roraima, namely Federacao de Pescadores dos Estados do Amazonas e Roraima (FEPESCA/AM/RR), was established in 1981, when 7 Colonias were joined and 20 "Associacoes" (preliminary stage of "Colonias" without Z-number) were founded. During the 1980s, however, FEPESCA worked only on paper. It was after the establishment of IBAMA in 1989 that FEPESCA started activities as an opinion leader of fishermen. Both colonia and FEPESCA are managed by registration fee of fishermen and fishing vessels without any support of the government fund.

As of June 2000, FEPESCA/AM/RR organized 14 Colonias and 10 Associacoes in the Amazonas State and 2 colonias in the Roraima State (Table 5.9.3-1). Total number of professional fishermen reached to 18,439 and 4,462 in Colonias and Associacoes, respectively. Considering that estimated total number of fishermen in those two States is 45,000 (information from FEPESCA/AM/RR), it can be concluded that about 50% of fishermen have been organized in the two States.

As an original business of FEPESCA/AM/RR, a frigorifico with ice making plant is operated in Manaus. The facility was the one transferred from Amazonas government (former CODEPESCA).

(3) CNP - National Level-

There is a total of 24 FEPESCAs in the country and they are unified as Confederacao Nacional dos Pescadores (CNP) at the national level. FEPESCA/AM/RR is the third biggest federation in terms of organized fishermen following marine fishery federations in São Paulo and Rio de Janeiro.

Table 5.8.3-1 Number of fishermen and fishing vessels registered at FEPESCA/AM/RR as of May 2000.

Organized municipals							None organzed municipal			Total	
Colonia				Associacoes							
Registered zone number and municipal		No. of fisher-men	No. of fishing vessels (*)	Municipal	No. of fisher men	No. of fishing vessels (*)	Municipal	No. of fisherm en	No. of fishing vessels (*)	No. of fisherm en	No. of fishing vessels (*)
Amazonas State											
Solimoes River											
Z-8	Iranduba	350	0	Tabatinga	480	65	Amatura	n.a.	2		
Z-9	Manacapuru	1,753	121	St. Antonioo do Ica	380	0	Careiro da Varzea	n.a.	43		
Z-4	Tefe	1,438	70	Coari	1,520	34	Fonte Boa	n.a.	2		
Z-3	Benjamin Constant	231	0	Codajas	262	15	Manaquiri	n.a.	13		
	Sub-total	*3,772*	*191*	*Sub-total*	*2,642*	*114*	*Sub-total*	*n.a.*	*60*	*6,414*	*365*
Amazonas River											
Z-13	Itacoatiara	1,387	45	Silves	280	0	Urucara	n.a.	3		
Z-16	Maues	850	14	Boa Vista dos Ramos	310	0					
Z-17	Parintins	1,200	74								
Z-14	Urucurituba	380	7								
Z-7	Presidente Figueiredo	210	0								
	Sub-total	*4,027*	*140*	*Sub-total*	*590*	*0*	*Sub-total*	*n.a.*	*3*	*4,617*	*143*
Purus River											
Z-18	Boca do Acre	550	13	Bururi	230	5					
Z-5	Canutama	360	0	Labrea	420	0					
	Sub-total	*910*	*13*	*Sub-total*	*650*	*5*	*Sub-total*	*n.a.*	*0*	*1,560*	*18*
Madeira River											
Z-19	Nova Olinda do Norte	800	0	Manicore	360	6	Borboa	n.a.	3		
				Humaita	220	16					
	Sub-total	*800*	*0*	*Sub-total*	*580*	*22*	*Sub-total*	*n.a.*	*3*	*1,380*	*25*
Negro-Solimoes River											
Z-12	Manaus	8,000	482								
Z-10	Novo Airao	200	4								
	Sub-total	*8,200*	*486*	*Sub-total*	*0*	*0*	*Sub-total*	*n.a.*	*0*	*8,200*	*486*
Negro River											
							Barcelos	n.a.	2		
							Sub-total	*n.a.*	*2*	*0*	*2*
Jurua River											
							Carauari	n.a.	4		
							Eirunepe	n.a.	5		
							Sub-total	*n.a.*	*9*	*0*	*9*
Unknown									*6*		*6*
Roraima State											
Negro River											
Z-1	Boa Vista	300	0								
Z-2	Caracarai	430	0								
	Sub-total	*730*	*0*	*Sub-total*	*0*	*0*	*Sub-total*	*n.a.*	*0*	*730*	*0*
Total		*18,439*	*830*		*4,462*	*141*		*n.a*	*77*	*22,901*	*1,054*

(*): Number of fishing vessels with license of IBAMA
Source: FEPESCA/AM/RR

5.9 Activities of Non-government Organizations (NGOs)

This section indicates the variety of types of nongovernment organizations that influence activities or outcomes of farmer organization in terms of accessing services other than municipality grants in the three municipalities. Two examples of the NGOs are provided. One is a federal NGO, which in the past has been active in organizing farmers into rural labor unions, but whose purpose has changed. The second is an environmental oriented NGO that is concerned with capacity building of local community organizations. Both have a potential of providing technical, organizational, managerial capacity building services to community farmer organizations. Briefly repeated is the identification of municipality based NGOs described in section 5.8.

Table 5.10.1 Types of Non-Governmental Organizations having some intervention with Rural Producers: Amazon

Type of Organization	Name of Organization
Representative Type NGOs	Federation of Industry, Federation of Commerce, Federation of Agriculture, Federation of Rural Workers' Unions, Fishing Federation, COJAB (Commissao Indigena da Amazonia Brasileira), OCB-AM (Sindicate and Organization of Cooperatives-Amazon), SESCOOP (Servicio National de Aprendizagem do Cooperativismo)
Catholic Church based NGO programs	CPT (Commissao Pastoral da Terra-Church Land Commission), CIMI (Commissao Indiginista Missioaria-Church Indian Commision), Pastoral Social, former Ecclesiastic Grassroots or Basic Christian Communities (CEBs) and Movimento de Educacao de Base (MEB)
National NGOs	ISA (Instituto Socio Ambiental-Alto Rio Negro),
International NGOs	ACDI/VOCA(Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance), Greenpeace, WWF (World Wildlife Fund), Amerinda
State/local NGOs	FVA (Fundacao Vitoria Amazonica), GTA-AM (Grupo de trabalho da Amazonia-discussion forum of a variety of NGOs in the state), APAE-Itacoatiara, Sociedade Pestalozzi de Maues, Centro Comunitario de Iranduba Sindicatos de Trabalhadores Rurais-STRs (Rural Workers' Unions), Colonias de Pescadores (fishing associations), woodworkers associations, ASTRI (Association of Rural Employees from Iranduba), Grupo da Paz (sports association-Iranduba)

(1) Federal level NGOs and Potential Linkages to Community Farmer Organizations

Few federal or national non-government organizations directly assist community farmer associations composed of poor farmers. They usually work with producers of higher economic status. They focus on environmental issues, meeting large farmer production needs, and promoting agricultural policies. The assumption is that the macro-level policies they promote will trickle down to small farmers. Employment benefit requirements for workers in agricultural cooperatives, for example, are mainly oriented to large cooperatives rather than to small village based cooperatives.

An example of a federal NGO that does work with small farmers and part-time small farmers engaging in extractive labor or processing of agricultural or extractive materials is the Federation of Rural Workers' Unions (FETAGRI). This is the national union of agricultural unions. STRs are rural labor unions or syndicates are organized at the local level and pay contributions as members of the Federation.

FETAGRI lobbies the State to provide technical assistance to farmers and has political party affiliations with CUT. Rural labor unions advocate what they politically believe are the best strategies to reduce farmer exploitative circumstances. These include: promotion of farmers guaranteed markets, integrated cropping to decrease farmer risks of crop failure, and unions to overcome middlemen exploitation.

Rural unions were once active in Itacoatiara Municipality and especially in settlement schemes, like Colonia Rondon. They have been active in Sagrado Coracao de Jesus, the most organized community in the study areas since 1987. In Iranduba Municipality STRs were active when Iranduba was still under the jurisdiction of Manaus and production focused on jute and malva production for large processing companies. Today, the STR has an active program to encourage women to register themselves as rural laborers to become eligible for pension benefits. In Maues, rural labor unions (STRs) are present in 37 rural communities, with 34 of them presently active with 5,525 members. Of these, about 1,300 have active members.

FETAGRI under grant funds provides members, who are often wage laborers and retired workers now engaged in farming, training courses on marketing, production efficiency, and how to form an organization. For current rural wage laborers, they provide courses on rights of workers. According to FETAGRI officials in Manaus, the most frequently demanded courses from farmers for them to run are in:

- How to use pesticides;
- How farmers can buy inputs and sell products directly;
- How to select the best crops to produce;
- How to register as a woman rural laborer.

On the request of farmer members of STRs, FETAGRI has developed a proposal for establishing a farmers market in Manaus. They contracted a study team to prepare the proposal and budget and have prepared all legal documents required of NGOs to verify they have no debt and have paid INSS (social security) to its members. They have submitted the request for permission to set up a market and access municipality funds for such endeavor for farmers in 1999. The request, as of November 2000, is still pending.

Registration with a labor union is extremely important for a poor farmer because it will entitle him, with regular dues, to proof of work for a certain number of years. This proof enables him to have eligibility for social security benefits in old age. The national women's movement has joined with rural unions for registering women as rural laborers and raising gender awareness of the roles of women and men in farm labor roles and gender contributions to family productive activities. The main assistance of FETAGRI and STRs now is execution of pension and other welfare

arrangements for rural workers.

(2) State/Local NGOs and Community Farmer Organizations

Non-governmental organizations in the Amazon have developed in response to the PPG7 Program. Some of the NGOs working in the central Amazon include World Wildlife Fund, Fundacao Vitoria Amazonica (FVA), and Greenpeace. Grupo de Trabalho da Amazonia (GTA) is an umbrella network of NGOs who lead discussions on sustainable development throughout the Amazon. Greenpeace supports a research program to minimize wastage of tropical timber trees in lumber activities and promote nursery plantations of tropical trees with private timber companies in Itacoatiara Municipality.

One of the most active NGOs in the State of the Amazonas is Fundacao Vitoria Amazonica (FVA). It was founded in 1990 in Manaus and operates with national and international grants. Its objectives are:

- Conserving the environment of the Amazon
- Improving the quality of life of inhabitants of the Amazon (notably along the Rio Negro for FVA)
- Advocating policies and programs for sustainable natural resource management of ecosystems
- Developing programs to sustain regional cultural diversity.

Among its multiple activities, FVA has four service programs available to government organizations and to NGOs. One is providing infrastructure (computers, software, boat, and speedboats) on a short-term basis. Another is providing fiscal management assistance. A third is enabling people to use its well-equipped geological laboratory for analyzing soils and geological conditions. A fourth is the possibility of contracting FVA for collecting and analyzing qualitative and quantitative data for the implementation of projects, as it does the same for its own projects.

(3) Municipality based NGOs

As indicated in section 5.8.3 municipality based NGOs were not found relevant to working on activities to strengthen farmer organizations in productive activities. Only three municipality based NGO s were registered with the Department of Social Welfare of the State Secretary of State for Workers and Social Welfare (SETRAB) [7] They are Centro Communitario de Iranduba, APAE (Itacoatiara), and Sociedade Pestalozzi de Maues. Each is town based, welfare or sports club focused, and not relevant as NGOs who could assist strengthening farmer organizations.

[7] Govt. of the State of the Amazon. Secretary of State of Workers and Social Welfare (SETRAB). List of NGOs with Formal Agreements with SEWTRAB. November 2000.

(4) Municipality based International NGO

An international NGO with a Maues municipality base is Amerinda. It is a Spanish NGO that works exclusively with the 30 Sautere (indigenous) communities. Their programs center on:

- Health management (especially yellow fever and measles control),
- Income generation activities with technical training in quality production and marketing of handicrafts
- Sautere handicraft store in Manaus
- Capacity building of Sautere communities with retention of indigenous knowledge and skills.

While they use participatory methodologies and capacity building strategies, their mandate is to serve indigenous communities. At one time, they approached IDAM to receive some technical assistance for the communities in which they work. IDAM has little technical expertise in Maues in how to work with indigenous communities to enable sustainability of culture and improve livelihoods and is already over stretched in providing extension in non-indigenous communities.

5.10 Capacity and Activities of Supporting Agencies

5.10.1 IDAM

(1) Overall activities

(a) Mandate of IDAM

The Institute of Agricultural and Livestock Development of the State of Amazonas (IDAM) is a task force organization of the Government of the Amazonas State responsible for sustainable development of agriculture sector including livestock management, fishery and aquaculture. It was established in March 1996 by succeeding partly functions from former EMATER.

Major mandate of IDAM is to provide farmers and fishermen with technical assistance and rural extension (ATER) services. In its actual activities, priority is given to family based small-scale farmers, although medium- and large-scale producers are also included as beneficiaries when the State doesn't have other entity that can advise them in this area.

(b) Organization and Covering Area of Local Units

As described in the Progress Report I, the headquarters of IDAM is composed of two departments (Technical Department and Administration and Finance Department). There are three sections, 14 subsections and 29 local units in the Technical Department. ATER is carried out through those local units together with technicians dispatched from the headquarters.

Covering areas and current staffing of each local unit are shown in Table 5.10.1-1. In this official allocation of covering area, it is aimed that ATER services shall be extended to all the 62 municipals of the State. However, due to limitation of staff members, equipment and budget, ATER is forced to be implemented at restricted scale presently.

The three local units of the study area namely Iranduba, Itacoatiara and Maués are recognized as major local units having more than 10 local staff members, although they are still considered insufficient to achieve the mandate successfully.

Table 5.10.1-1 List of IDAM local units, covering area and number of staff as of December 2000

No.	Location of local units	Covering area	Technical staff		Administrative staff	Total
			Graduated	Non-graduated		
1	Apui	Apui, Novo Aripuanã – parte	3	5	2	10
2	Autazes	Autazes	2	3	3	8
3	Barreirinha	Barreirinha	-	1	1	2
4	Boa Vista do Ramos	Boa Vista do Ramos	-	1	1	2
5	Boca do Acre	Boca do Acre, Pauini	1	3	2	6
6	Borba	Borba	-	4	3	7
7	Carauari	Carauari, Itamarati – parte	-	3	3	6
8	Careiro da Várzea	Careiro da Várzea	-	4	2	6
9	Careiro Castanho	Careiro Castanho, Manaquiri – parte	1	1	3	5
10	Coari	Coari	1	4	3	8
11	Eirunepé	Eirunepé, Itamarati - parte	1	3	8	12
12	Envira	Envira	-	3	1	4
13	Guajrá	Guajará, Ipixuna	-	1		1
14	Humaitá	Humaitá, Manicoré - parte, Canutama - parte	2	4	6	12
15	Iranduba	Iranduba, Manaquiri - parte	1	7	3	11
16	Itacoatiara	Itacoatiara, Urucurituba	2	5	9	16
17	Lábrea	Lábrea, Canutama - parte, Tapauá	-	2	5	7
18	Manacapuru	Manacapuru, Caapiranga, Novo Airão, Anamã	1	4	5	10
19	Manaus	Manaus	5	6	5	16
20	Manicoré	Manicoré, Novo Aripuanã - parte	2	2	7	11
21	Maués	Maués	1	6	5	12
22	Nhamunda	Nhamundá	1	3	1	5
23	Parintins	Parintins	3	9	11	23
24	Presidente Figueiredo	Presidente Figueiredo	2	4	2	8
25	Rio Preto da Eva	Rio Preto da Eva	2	5	3	10
26	Silves	Silves, Itapiranga - parte	-	2	1	3
27	Tabatinga	Tabatinga, Atalaia do Norte, Benjamin Constant	-	1	3	4
28	Tefé	Tefé, Alvarães, Uarini, Japurá,Maraã - parte	2	3	1	6
29	Urucará	Urucará, São Sebastião do Uatumã, Itapiranga - parte	1	7	4	12
Total			**34**	**106**	**103**	**243**

Source: IDAM Plan, Program and Project Management, IDAM Proposal for Agriculture Developmentn1999-2002

(c) Assistance to Rural Credit Scheme

IDAM provides farmers and fishermen with technical assistance on application of rural credit of banks and monitoring of the accredited programs thereafter. This is one of most important ATER services of IDAM. Rural credit programs to be assisted by IDAM are planned as shown in Table 5.10.1-2, although actual achievements seem to be far behind from this plan.

Table 5.10.1-2 Summary of Rural Credit Program - 2000

Unit : thousands (x 10^3)

FINANCED ACTIVITIES		AFEAM *FMPES*	AFEAM *FTI*	BASA	BB and BASA	To be Defined	Total
AGRICULTURE							
Horticulture	*(citros, cupuaçu, coconut, açaí, abacaxi, banana, maracujá, papaya)*	5,357	-	8,749	-	-	14,106
Annual Culture	*(Maize, Rice)*	-	-	-	5,000	-	5,000
Olericulture	*(Vegetables)*	-	-	-	-	285	285
Plasticulture	*(Grennhouse Culture)*	-	2,310	-	-	-	2,310
Industrial Culture		2,000	-	3,320	-	-	5,320
Agroforestry		-	-	1,230	-	-	1,230
Agro-industry		-	-	300	-	700	1,000
LIVESTOCK							
Cattle Breeding	*(Breeding / Hattening)*	-	-	16,392	-	-	16,392
	(Infrastructure)	-	-	9,900	-	-	9,900
	(Inputs)	-	-	6,000	-	-	6,000
	(Bovine Matrix Acquisition)	-	20,000	-	-	-	20,000
Swineculture	*(Breeding / Hattening)*	210	-	-	-	-	210
Caprine(goat) and Ovine(sheep)		300	-	120	-	-	420
Chicken		800	-	-	-	-	800
Egg Production	*(Industrial)*	300	-	-	-	-	300
	(Familiar)	200	-	-	-	-	200
FISHERY							
Fishing		1,000	-	-	3,067	-	4,067
Aquaculture	*(Barragem, Viveiro,Gaiola)*	-	-	-	6,903	-	6,903
OTHER		-	-	-	-	-	-
Trade Fair		1,000	-	300	-	-	1,300
TOTAL		**10,167**	**22,310**	**46,011**	**14,970**	**985**	**94,442**

Source: P.O./IDAM/Management: RURAL CREDIT

At present BASA and AFEAM are carrying out such special loan program for rural farmers. Taking example from BASA's small-scale fishery and aquaculture support program, the maximum credit amount is R$ 25,000/person with annual interests of 5%. The repayment period is 8 years with a grace period of 2 years.

When the application of credit is supported by IDAM and the credit is approved, IDAM will be able to receive 1.5% of total credit amount from the recipients as technical support charge.

(d) Preliminary Discussion on the Future Capacity Building of IDAM

i) Collaboration with municipal, state and federal governments

IDAM has current institutional function for promoting policy changes, developing livelihood programs, and delivering community services. These function can be strengthened to ensure government policies and programs directly deliver services and transfer knowledge to farmers. IDAM needs to continue to strengthen its leadership role to advocate for more municipalities and federal government services to direct benefits towards rural families, especially those living in riverine communities in the State of Amazonas.

Farmers recognize their problems are not only production based. They would like IDAM to invest more resources into helping them get additional services

such as marketing and communication. They want IDAM to provide them too their modern production technical assistance to help them better develop their economic base. Now, however, farmers and communities are more tied into credit programs. They know they need to learn how to deal with various problems which happen in the community to other government programs. They do not have other state institutions that provide them such information that relates to their community development needs.

At the present time, they expect IDAM to make these linkages for them and negotiate with municipal administration on their behalf. However, as demand increases for services in communities, it is proposed that it would be more efficient for IDAM and more empowering to communities if IDAM helped set up systems whereby communities learn how to demand and prepare community plans. It would be more community capacity building if IDAM trains them how to demand services and how to negotiate to obtain these services themselves with backup support from IDAM.

ii) Encouragement of a demand driven approach for community development

As indicated elsewhere, the traditional system of linkages for technical assistance and grants is based on good working relationships with municipality administration. IDAM community organization training now focuses on forming associations to access short term grants that are part of municipality development plans and to which there is a budget for grants or services, or IDAM community training also is aimed at helping farmers prepare micro-projects to access credit from banks.

Based on PRONAF experience, it is proposed that IDAM try a pilot program to expand its development and facilitation roles by strengthening its advocacy and leadership roles with and for rural community development in the State of Amazonas. In this aspect IDAM is requested to continue building effectively its linkages with municipal administration. It will also require IDAM to hold policy roundtables concerning rural development issues including justification of financial investments to enhance a demand-driven approach for rural people's livelihood improvement.

(2) IDAM Iranduba Office

(a) Staff and Equipment

The IDAM Iranduba Office (IDAM/IRA) has a total of 18 staff members, namely 9 agricultural technicians, 1 livestock technician, 1 community technician and 7 administrative staffs. There is no fishery technician.

Major office equipment is telephone, fax, manual typewriter, computer and printer.

Copy machine is not facilitated.

As for transportation, there are 4 vehicles (1 pick-up and 3 sedans), 1 motor cycle and 2 motorboats. However, all the 4 vehicles are not functional. ATER activities of IDAM/IRA are thereby technically difficult at the moment.

(b) Operation Cost

The current, estimated annual operating costs of IDAM/IRA are approximately R$ 85,000 as shown in Table 5.10.1-3.

Table 5.10.1-3 Annual operating budget of IDAM/IRA in 2000

Items of Budget		Amount (R$)
Operation Cost		
Fuel + food supply		47,583
Management of vehicles		7,200
Management of office		9,720
	Subtotal	64,503
Additional cost for repair of facilities		
Lodging		2,000
Local Office Building		2,500
Storehouse		3,500
Floating House		1,500
	Subtotal	9,500
Additional cost for car repair		
	Subtotal	11,000
Total		85,003

Source: IDAM/IRA

(c) Important Activities

i) Support to vegetable cultivation

Agriculture of Iranduba is characterized by production of vegetables to meet the demand of Manaus. IDAM/IRA has continuously attempted to support vegetable farmers with high priority. Based partly on such IDAM/IRA's assistance, some new production technologies such as plasticultura method have been introduced recently. Expected technical assistance of IDAM/IRA on cultivation of vegetables is summarized in Table 5.10.1-4.

Table 5.10.1-4 Expected technical assistance of IDAM/IRA on cultivation of vegetables in 2000

Vegetables	Assisted farmers		Expected Production
	Number	Area (ha)	
1. Cabbage	94	48	768(t)
2. Cucumber	87	46	920(t)
3. Sweet Pepper	66	34	340(t)
4. Tomato	62	18	216(t)
5. Lettuce	184	56	3,472,000 (unit)
6. Spring Onion	122	21	378,000 (unit)
7. Leaf Cabbage	48	14	308,000 (unit)
8. Coriander	117	42	756,000(unit)
9. Small Sweet Pepper	41	12	36(t)
10. Pumpkin	43	22	660(t)
11. Watermelon	125	80	160,000 (fruits)
12. Long Bean	48	10	40,000 (unit)
Total	1,037	403	

Source: IDAM/IRA, Plan of Operation 2000

ii) Rural credit

IDAM/IRA assisted rural credit programs are summarized in Table 5.10.1-5.

Table 5.10.1-5 IDAM/IRA assisted rural credit programs

Crops	Project in Progress				Planned Projects			
	No. Producer	No. Projects	Area (ha)	Value ('000R$)	No. Producer	No. Projects	Area (ha)	Value ('000R$)
Cupuaçu	26	26	36	134	30	30	60	300
Pupunha	47	57	81	482	-	-	-	-
Coconut	21	21	38	162	25	25	25	125
Papaya	125	125	139	645	15	15	15	75
Passion	111	111	121	403	20	20	20	100
Mandioka	86	86	118	102		-	-	-
Vegetables	131	137	172	438	60	60	60	300
Corn	5	5	9	3	-	-	-	-
Citrus	17	17	27	126	20	20	40	200
Plasticulture	6	7	1	176	65	65	26	1,900
Banana	8	8	8	13	20	20	20	200
Guaraná	-	-	-	-	30	30	60	300
Total	583	600	750	2,636	285	285	326	3,500

Source: Plan of Operation 2000, Iranduba

(d) Problems Identified

The following problems are identified about activity of this office:

- Area and families to be covered by one technical staff are too large to provide them with sufficient ATER services.
- Few engineers are assigned for livestock, fishery and aquaculture.
- Percentage of gualified staff is low.
- Transportation means are very poor, which restrict routine access to communities.
- Office equipment is not sufficient, which hamper efficiency of activity.
- There are few opportunity for technical training despite technical level of staff seems relatively low.

Throughout the field survey, those problems are not specific to IDAM/IRA but commonly found in all the local units.

(3) IDAM Itacoatiara Office

(a) Staff and Equipment

The IDAM Itacoatiara Office (IDAM/ITC) has a permanent staff of 14 people such as 1 manager, 8 agricultural technicians and 5 offices assistant.

IDAM/ITC's major assets include 2 aluminum speedboats, one passenger car and 2 trucks.

(b) Operation Cost

The current, annual operating costs for IDAM/ITC are approximately R$ 52,000 as indicated below:

Table 5.10.1-6 IDAM/M Annual Operating Budget (for 2000)

Item		Cost (R$)
Monthly Operating Costs		
Fuel + Food		57,092
Vehicle Maintenance		4,800
Building Maintenance		6,000
	Subtotal	67,892
Additional Requested Expenses		
Building Upgrade		15,000
Car Repairs etc.		18,000
	Subtotal	33,000
Total		100,892

Source: IDAM/ITC

(c) Important Activities

i) Extension services to farmer's associations

Currently, extension staff of IDAM/ITC focuses on assisting 42 farmer's associations (Table 5.10.1-7). Most of these associations are based on "terra firme". On average, each extensionist is responsible for about 272 producers spread out over 4-5 different associations.

Table 5.10.1-7 Activity areas of IDAM/ITC extensionists

Association	# Farmers	Association	# Farmers
1. Colonia Rondon	50	22. Monte Crist/Arary	60
2. Colonia Boa Esperanca	23	23. Dos Pec. E Agric. Do Amatary	50
3. Colonia do Piquia	60	24. São Sebastiao	20
4. Colonia Novo Remanso	50	25. Do Livramento	40
5. São Francisco	25	26. Unidos do Cana	30
6. São Raimundo	30	27. São Francisco	40
7. São Sebastiao do Aruma	25	28. São João	30
8. Sagrado Coracao de Jesus	60	29. Santo Antonio	30
9. São João do Araca	50	30. Nova Jerusalem	20
10. São José das Pedras	25	31. N. Senhora das Gracas	30
11. São Pedro Iracema	50	32. Sagrado Coracao de Jesus	20
12. Bom Jesus	50	33. São Francisco do Pahi	19
13. Colonia Nova Vida	30	34. Shalon	22
14. Vila Batista	50	35. Menino Deus	22
15. Dos Criadores do M. Amazonas	80	36. Santa Maria Taboca/Rio Urubu	12
16. Colonia do Itaubal	30	37. Unidos do Cana	15
17. Visconde de Maua	25	38. São Lazaro/Arary	18
18. Ajuricaba	35	39. Agrirosa	22
19. Santa Rita	40	40. Boa Vista/Pombo	10
20. Primavera	25	41. Diversos	600
21. Monte das Oliveiras/Arary	50	42. Parica	20
TOTAL			1,993

Source: IDAM Itacoatiara Plan of Operation 2000

ii) Assistance to plant production

The IDAM/ITC manages a variety of different agricultural activities. The primary activities in "plant production" are summarized in Table 5.10.1-8

Table 5.10.1-8 Primary "plant production" activities assisted by IDAM/MAU, 2000

Activity	# Farmers Assisted	Area (ha)	Production (t)
Food Crops	1,530	2,900	7,204
Industrial Crops	545	450	292
Fruits	1,170	1,645	-
Vegetables	185	76	-
Agro-forestry	130	260	-
TOTAL	3,560	5,331	-

Source: IDAM

iii) Rural credit

In addition to providing technical assistance in the area of crop production, IDAM/ITC specialists manage, initiate, and evaluate credit programs with the farmers. Rural Credit is planned to assist 1,254 farmers on a 1,976.8 has of land and a total of R$ 7,631,666.00. The following table outlines the rural credit programs for crop production that are already in progress:

Table 5.10.1-9 Description of IDAM/M rural credit programs for main farmings

Farming system	Projects in Progress (2000)		
	# Production	Area (ha)	Value ('000 R$)
Açaí/Cupuaçu	104	212	660
Cup/Pup/Gua/Bov	625	870	4,579
Cup/Inv	67	120	399
Mix*1	176	300	386
Mix*2	152	220	498
TOTAL	1,124	1,722	6,522

Source: IDAM 2000; *1 (Coc/Cup/Ban/Mand/I. Agric), *2 (Bov/Bub/Gua/Abac/Ban/I. Agric)

(c) Specific Problems Identified

The following problems are identified about activity of this office:

- Inconvenient transportation measures.
- The low rate of staff of a university graduation level
- Very few opportunities for upgrading knowledge of extension staff
- Poor facility of local office
- Inadequate office equipment

(4) IDAM Maués Office

(a) Staff and Equipment

The IDAM Maués Office (IDAM/MAU) has a permanent staff of 12 people such as 1 manager, 5 agricultural technicians, 3 technical assistants, 1 office assistant and 2 drivers.

IDAM/MAU's major assets include 2 aluminum speedboats, 125 hp engine, 140 hp engine, 1 large passenger boat (currently non-functional), and one old vehicle.

(b) Operation Cost

The current, annual operating costs for IDAM/M are approximately R$ 52,000 as indicated below:

Table 5.10.1-10 IDAM/M Annual Operating Budget (for 2000)

Item	Cost (R$)
Monthly Operating Costs	
Fuel + Food	41,928
Vehicle Maintenance	8,004
Building Maintenance	3,000
Subtotal	52,932
Additional Requested Expenses	
Building Upgrade	4,000
Car Repairs	2,000
Motorcycle Repairs	1,000
Outboard Motor Repairs	2,000
Boat Repairs	8,000
Subtotal	17,000
Total	69,932

Source: IDAM/MAU

(c) Important Activities

i) Extension services to farmer's associations

Currently, extension activity of IDAM/MAU focuses on assisting 19 farmer's associations (Table 5.10.1-11) scattering in 9 principal localities of this municipal. Except for three, all of these associations are based on "terra firme". On average, each extensionist is responsible for 182 producers spread out over 3-4 different associations. Usually it takes a boat trip of about 3 hours just to reach most of these sites.

Table 5.10.1-11 Activity areas of IDAM/MAU extensionists

Association	Distance (hr)	# Farmers	Staff Person
1. S.Marcos	3	18	JC (163)*
2. S.João	3	85	JC
3. S.Maria	3	60	JC
4. B.Jesus	5	150	AJ (239)
5. P.Alegre	5	52	AJ
6. Freguesia	5	37	AJ
7. NS de Lourdes	5	90	IR (187)
8. T.Neves	5	22	IR
9. S.Francisco	5	75	IR
10. B.Jesus	1	57	PL (121)
11. M.Salem	1	34	PL
12. B.Futuro	1	30	PL
13. S.José	1	45	CP (193)
14. M.Deus	1	75	CP
15. V.Cruz	.5	73	CP
16. S.Maria	2	90	RV (192
17. A.Alegre	2.5	45	RV
18. Pedreiro	2.5	27	RV
19. S.Clara	3	30	RV
TOTAL		1095	

Source: IDAM/MAU, 1999 ; *( ) =Total # farmers attended

ii) Assistance to plant production

The IDAM/MAU manages a variety of different agricultural activities. The primary activities in "plant production" are summarized in Table 5.10.1-12.

Table 5.10.1-12 Primary "plant production" activities assisted by IDAM/MAU, 2000

Activity	# Farmers Assisted	Area (ha)	Production (t)
Food Crops	660	790	1996
Guaraná	699	1224	292
Fruits	445	545	-
Vegetables	396	348	-
Agro-forestry	6	6	-
TOTAL	2206	2913	-

Source: IDAM/MAU

Considering the annual production of guaraná in Maués is expected to be about 300 tons for 2000, the above table indicates that IDAM/MAU is attempting to assist practically all the guaraná farmers in the municipality.

iii) Rural credit

In addition to providing technical assistance in the area of crop production, IDAM/MAU specialists manage, initiate, and evaluate credit programs with the farmers. The following table outlines the rural credit programs for crop production that are already in progress or planned:

Table 5.10.1-13 Description of IDAM/M rural credit programs for crops

Crops	Projects in Progress (2000)			Planned Projects (after 2000)		
	# Prod.	Area (ha)	Value ('000 R$)	#Prod.	Area (ha)	Value ('000 R$)
Guaraná (new)	655	1,180	4,670	50	100	470
Guaraná (old)	15	53	27	500	1,000	500
Fruits*	280	342	310	87	174	449
Cassava	40	77	39	0	0	0
TOTAL	990	1,652	5,046	637	1,274	1,419

Source: IDAM 2000; * (cupuaçu + açaí + pupunha + maracujá)

It is important to note that credit support for guaraná farmers will decrease substantially in future projects. There is clearly a new emphasis in support of assisting in the recovery of old guaraná farms, as opposed to the planting of new ones.

iv) Training program

IDAM/MAU programs 1-2 technical courses in guaraná production every year, and maintains a demonstration farm where new EMBRAPA clones are being evaluated, as well as agronomic techniques to assist in the recovery of old guaraná trees. IDAM/MAU is also cooperating with EMBRAPA in a program that is scheduled to deliver over 20,00 cloned seedlings to guaraná farmers.

IDAM/MAU also maintains programs and conducts training in the following areas:

- Beef Production
- Poultry Production
- Pork Production
- Cassava Quality Improvement
- Strengthening of Associations
- Social Planning/Well Being

(c) Specific Problems Identified

Given the difficulty in access to plantation sites by road associated with large area of the municipality, the biggest constraint is inconvenient transportation measures. This is due mainly to deficit of budget for fuel (especially gasoline for the speedboats and cars). Sometimes there are periods of several months where no travel funds exist and the staff has no choice but to stay at the office. In addition, a large passenger boat of IDAM/MAU is now not functional, which causes difficulty in approaching for remote project sites.

Most staff are only scheduled for one training course per year, and often the training does not occur because of lack of travel funds at the time. Although most of the technicians have developed friendly relations with the target communities, most farmers expect them to have more technical expertise.

The office building, furniture, etc. is poor and its equipment like a copy machine, a personal computer, etc. is also inadequate and internet connection also is not available.

5.10.2 IDAM's Activities on Fishery and Aquaculture

Fishery engineers are not allocated in the local units of study area at present. IDAM's activity in a field of fishery and aquaculture is reviewed for the state level in this sub-section.

(1) Staff

There is a total of eight fishery engineers in IDAM; 2 in headquarters (Aquaculture and Fishery Management Section), 2 in Manaus municipal office, 1 at the IDAM Balbina Hatchery in Presidente Figueireito, 1 each in municipal offices of Rio Preto da Eva, Printins and Coari. Number of fishery engineer in IDAM is much less than that of agronomists. This makes fundamental difficulty in ATER services of this sub-sector.

(2) Credit program

(a) Credit program for small-scale fishery

As for small-scale credits for fishery activities, a total of 408 programs with an average credit amount of R$ 2,837 is going to implement in 2000 (Table 5.10.2-1). Those credits are mostly used for purchasing various fishing equipment

such as fishing gear and net, outboard engine, ice box, fuel and other consumables and repair of boat and engine.

However, multiple beneficiaries in this study complained about technical service charge of IDAM (1.5-2.0% of credit amount), because of few technical assistance receiving from IDAM.

Table 5.10.2-1 IDAM-assisted credit programs for fishery and aquaculture

	Support for artisanal fishery			Aquaculture development		
	No. of program	Amount (R$)	Average (R$/program)	No. of program	Amount (R$)	Average (R$/program)
1998	n.a.	2,050,370	-	0	0	-
1999	238	1,125,587	4.729	0	0	-
2000	408	1,157,377	2.837	4	325,074	81,269

Source: IDAM, Rural Credit Management Section

(b) Credit for aquaculture

Unlike the credit for small-scale fishery, it is now difficult to obtain credit for aquaculture development. As shown in Table 5.10.2-1, credits for aquaculture have been suspended for last two years although there was a strong demand for credit among small-scale farmers.

The superintendent of BASA pointed out that knowledge and technology of small-scale operators about aquaculture seemed insufficient and profitability from aquaculture was questioned.

In 2000, four aquaculture programs were proposed through IDAM for evaluation of bank. One is from Iranduba, and three from Manaus. Those credit programs are aiming for construction of barragem and ponds for fish culture. The average credit amount requested is as large as R$ 81,269, or more or less 20 times comparing to that for artisanal fishery.

(3) Seed production and distribution

IDAM has been operating a fish hatchery located besides Balbina Lake (hereinafter, called as the IDAM Balbina Hatchery or IBH), Presidente Figuereito since 1991. Balbina Lake is a man-made dam for the hydro electric power plant of the Manaus Energia LTDA (former Electronorte LTDA), a public electric company of the Federal Government. This company constructed all the hatchery facilities, and rents them to IDAM based on the agreement that has been renewed every five years.

At present, IDAM allocates the Hatchery one fishery engineer and several supporting staff, and produces juvenile tambaqui, curimata and a little amount of matrincha. Total production amount of 4-5 cm size fry is approximately 1 million per year (Table 5.10.2-2). The fry of tambaqui and crimata is now able to produce all year round technically so that the production is carried out based on the request from fish farmers (Figure 5.10.2-1).

Table 5.10.2-2 Production of fry and post larvae at the IDAM Balbina Hatchery[*1)]

	Fry production			Post larvae[*3)]
	For sale	Free[*2)]	Total	
1995	218,300	35,000	253,300	-
1996	610,900	80,000	690,900	600,000
1997	960,000	121,000	1.081,000	1,500,000
1998	895,000	124,000	1.019,000	-
1999	1.311,000	32,000	1.343,000	-

Source: IDAM, Aquaculture and Fishery Management Section
Remarks: *1) Total of tambaqui, curimata and matrinchã
*2) donated for Presidente Figueiredo due to collaboration work
*3) donated for Rio Preto Da Eva due to special request

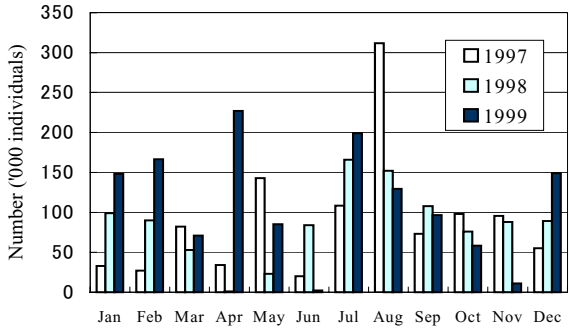


Figure 5.10.2-1 Monthly fry production amount at the IDAM Balbina Hatchery

Source: IDAM, Aquaculture and Fishery Management Section

As the only one public hatchery in the Amazonas State, IBH is selling the fry through IDAM headquarters at the price cheaper than that of private hatcheries. Annual sales of fry was about R$ 52,000 in 1999, which was transferred to miscellaneous revenue of IDAM.

Produced fish fry are now distributed mainly for the six municipals such as Manaus, Presidente Figueireido, and Rio Preto da Eva, Manacapuru, Coari and São Gabriel da Cachoeira (Annex 5.10.2-1).

(4) Other extension activities

Extension of aquaculture technology is one of the most important mandates of IDAM. In 1999, IDAM conducted a total of 8 training courses related to fishery and aquaculture, two of which were held in Maues. On 21-22 November 2000, IDAM was able to organize the first seminar on aquaculture in Rio Preto da Eva collaborating with municipal office, PRONAF, EMBRAPA and INPA.

However, those extension activities are not sufficient comparing to the needs of beneficiaries. There is a fundamental difficulty about linkage with local units due to limitation of staff presently.