

URBANIZATION AND THE CONSUMPTION OF REGIONAL FRUITS IN WESTERN
BRAZILIAN AMAZON

By

ANA CAROLINA BARBOSA DE LIMA

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To Dona Fina, Vera and Ceça, three *nordestinas arretadas* who have never doubted my capacities and always encouraged my idealistic ventures as if they were achievable

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Abstract of Thesis Presented to the Graduate School
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Ana Carolina Barbosa de Lima

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This thesis examines the effects of urbanization on the diversity of regional fruit consumption by populations of cities and towns in the state of Acre, western Brazilian Amazon. Urbanization was assessed using three components: the ratio of urban over total population number in municipalities, urban center size, and connectivity to outside areas. The findings were focused on the distribution system of regional fruits and individual lifestyle factors behind changes in consumption, based on the operational model for understanding food intake behavior proposed by Peltó (1981). The socio-political framework of this study comprises a new development model which has been undertaken in the state of Acre aiming at combining sustainable use of resources and urban expansion, emphasizing a forest identity. Results show that the diversity of regional fruit consumed by the population is lower in highly urbanized settings, although these products are available for purchase at open markets (fresh fruits and fruit pulps) and supermarkets (fruit pulps). Findings point to the importance of other sources of regional fruits such as garden lots, urban forest fragments and fruit exchange between relatives and friends. Moreover, income constraint, diversity of tree fruits in garden lots

and quality of processed fruits traded were shown as key factors influencing the consumption of regional fruits in this region and should be addressed in policies targeting biodiversity conservation, nutritional security, food safety and population health in the Amazon.

CHAPTER 1 FOOD HABITS AND URBANIZATION IN THE AMAZON

Never again will the Amazon be the same; for these Mineiros, Gauchos, Goianos, and even Paulistas are modifying Amazon culture and in turn they are learning from the Amazon people (Charles Wagley, 1975).

The Study of Food Habits and Urbanization in the Amazon

The interaction between biological and cultural processes in human food selection is a crucial aspect in the study of socio-cultural factors that affect food intake. This thesis examines the effects of urbanization on the consumption of regional fruits in the Amazon analyzing biological and cultural interactions. It aims to assess how different peoples translate biological information about foods, such as safe versus dangerous, into cultural likes and dislikes or persistence of consumption traditions.

Pelto *et al.* (1989) have contributed immensely to studies in nutritional anthropology taking a multidisciplinary approach to the relationships of nutrition to socio-cultural, economic and ecological processes, especially in regards to research methods in this field. They affirm that before evaluating the adaptive or maladaptive nature of food habits one should be careful to consider how food habits relate to short and long-term nutrition and health, preservation of the food environment, and, perpetuation of a particular society and culture. Pelto *et al.* (1989) affirm that each culture structures its food environment and ethnobiological understandings of the relationship between food and health in particular ways.

Demographic changes in the U.S. have prompted Kittler and Sucher (2000) to study food habits from a cultural perspective. They claim that migration changes are essential to all facets of food production and consumption because decisions on the distribution system of foods are often dependent on the preferences of a targeted

population. Therefore, urbanization, as a key trend in demographic change in Latin America and in the Amazon, makes the study of traditional foods, such as tropical fruits in the Amazon, particularly relevant. Urbanization has been an important trend in the Brazilian Amazon at least since the 1970s, and has brought a number of changes to food distribution systems and consequently to food consumption by the growing urban population which impact all aspects of food security such as access to food, local crop production, food markets, diet quality and population health.

In addition, given the Amazon context, the study of food habits or cultural foods has an added dimension – biodiversity and agrobiodiversity conservation. This is especially relevant considering the study of regional fruits, which may be native or well adapted crops. Biodiversity loss in the Brazilian Amazon is of major concern, and according to Fearnside (1999) its maintenance is a function to which many attribute value beyond the commercial sale of products. Moreover, the role of urban garden lots and social forestry in improving agrobiodiversity, food security, social networking and reinforcing cultural identity have been discussed by a number of authors (Altieri, 1999; WinklerPrins and Souza, 2005; Nair, 2007; Galluzzi *et al.*, 2010).

The operational model to study food intake behavior developed by Pelto (1981) was used to examine the consumption of regional fruits in the Amazon (Figure 1). According to Pelto (1981) the main factors affecting food intake behavior are associated with the social-economic-political system, the food production and distribution system and a number of lifestyle factors, which for each individual will result in a different diet behavior.

In the case of this study, the social-economic-political system was considered as a conceptual framework to analyze regional fruits distribution system and lifestyle factors. The aim was to understand how urbanization and development in the Brazilian Amazon are affecting regional fruit consumption. Not all lifestyle factors noted by Pelto (1981) were considered, but through the use of qualitative methods the most important factors were taken into account, given that they were identified by consumers themselves as significant for influencing their fruit consumption behavior.

Urbanization in the Brazilian Amazon

The Legal Brazilian Amazon is a term defined by the government to delimitate the Amazon region for political and economic purposes. It is comprised by nine Brazilian states located in the north region of the country. The states of Acre, Amapá, Amazonas, Mato Grosso, Pará, Roraima, Rondônia e Tocantins are entirely part of the Legal Amazon, whereas part of the state of Maranhão is also included; the area extends for approximately 5.217.423 km² representing 61% of the Brazilian territory.

According to IBGE (Brazilian Institute of Geography and Statistics), an urban area is defined by the internal area of the urban perimeter of a city or town, determined by municipal law. Population density is one of the parameters used to classify urban areas, ranging from a “small town” – 500 to 100.000 inhabitants – to a “megacity” with more than 10.000.000 inhabitants. An urban area is defined differently among countries, for instance, the U.S. Census Bureau defined urbanized areas as densely settled areas containing at least 50,000 people, and urban clusters as densely settled areas with a population of 2,500 to 49,999 inhabitants. As an example, considering the U.S. Census Bureau definition, all capital cities in the Amazon region would fall under the category of urban areas and also the two largest cities in the state of Acre, subject of this study.

The Brazilian Amazon is a highly heterogeneous space, where urbanization is taking place in various forms, as a reflection of the social economic and political system and transformations in local, state, federal or global levels. For instance, migration from rural to urban areas could be a result of policies that force people to move from agriculture to other economic activities or the search for better health and education services. Mostly urbanization is a result of interactions among economic, political and social factors encouraging people to agglomerate in cities and towns.

Before the 1960s, the Brazilian Amazon experienced two massive migrations, in the late nineteenth century and during World War II, primarily involving people coming from the northeastern region of the country, comprising of workers destined to tap rubber. Urbanization in the region, with great numbers of rural people migrating to urban centers, was predominant during the 1970s, nearly a decade later compared to Brazil as a whole. In fact, in 1975, in a new edition of his 1953 book, *Amazon Town*, Charles Wagley affirmed that Brazil had “embarked upon a gigantic program for the ‘conquest of the Amazon.’” He was referring to the construction of roads in the Brazilian Amazon Valley cutting through from north to south (Belém-Brasília) in the 1960s and from east to west in the 1970s, the Trans-Amazon Highway orienting part of the Amazon region to the economic center of the country (southeast and south). Wagley sounded rather pessimistic, acknowledging the danger of developing the Amazon under a purely extractive economy, threatening the ecological system and not benefiting the local and traditional population living in the area, especially early migrants, the rubber tappers, who developed a singular identity and culture.

Apart from some scholarly analysis, such as the recounts of Charles Wagley, the rapid urbanization of the Amazon was a largely unrecognized regional trend in the 1980s and late 1990s until Browder and Godfrey (1997) published their book about the effects of this trend in rainforest cities. They were precise about the importance of the urbanization phenomenon, despite the regions generally accepted vision as having exclusively forested areas, often cited as impenetrable and even previously considered a “green hell”. In forty years, from 1940 to 1980, the degree of urbanization in the Brazilian northern region almost doubled, rising from 27% to 51.7%; this trend has continued in the region with the urban population ratio reaching 73.5% in 2010 (Figure 1-2).

The Brazilian Amazon is surprisingly urbanized compared to the same region in other countries. For instance, Iquitos, the largest city in the Peruvian Amazon, is located in the Maynas Province with an urbanization degree of 75% (INEI, 2008). Municipalities that house state capitals in the Legal Brazilian Amazon have an urbanization ratio over 90% (except from one, Porto Velho), with some reaching almost 100% (Guedes *et al.* 2009). For this reason some researchers began to refer to the Amazon region as an “urban forest” during the 90's (Becker, 1995).

Some of the first studies of urbanization in the Amazon were conducted by Browder and Godfrey (1997) and Becker (1995); they have a very similar approach to the definition of the Amazon frontier as a potential space for the developing of new realities in the Brazilian context, the leading front of a national project. The transformation in the Amazon region is not considered simply as a consequence of a development model, but part of its powering force. Becker (2004) also argues that in the

last 15 years the main driving forces, actors and motivations related to this process changed and grew in scale, representing the potential for real transformation on global, national and local scales.

The logic of a disarticulated urbanization was suggested by Browder and Godfrey (1997) to explain this process of migration in the Amazon region, since it does not follow traditional models or any dominant principle. Some aspects behind their theory of disarticulated urbanization in the Amazon are:

- Heterogeneity of the Amazon territory with a number of different social groups and special structures;
- Irregular settlement patterns unrelated to any principle of spatial organization, reflecting multiple logics of settlement positioning, resulting from the different Brazilian economic phases;
- Autonomy of city development in relation to agricultural production, with urban centers possessing a more complementary function (providing services for agriculture) than representing a consequence of agricultural modernization;
- Brazilian industrial development disconnected from Amazon region, with a few exceptions; v) velocity of development growth in the region beyond its internal limits due to links with the global economic system;
- Technological links to global information circuits present in remote urban centers;
- Multiple and often contradictory governmental policies targeting the frontier;
- Intense mobility among rural and urban settings without clear dichotomous features.

Guedes *et al.* (2009) side with the notion of disarticulated urbanization, arguing that the Amazon is characterized by important regional, sub-regional and local urban networks that are inter-dependent and have developed with strong links to the surrounding rural environment. Specifically in the state of Pará, Guedes *et al.* (2009) affirm that there is a growing physical and functional connectivity between regional and a number of sub-regional cities. They use the example of Santarém as a regional city

and Belterra, Aveiros, Monte Alegre, Rurópolis, and Placas as sub-regional ones and suggest that the increased connectivity is a consequence of deficient services and economic conditions for a number of small cities. They argue that rural areas and villages with deprived infrastructure are close to towns, inevitably attracting immigrants, permanently or temporarily. Several sub-regional cities play a central role, which they called “city-nodes” because they function as providers of job opportunities, schools and health services. Their relative isolation in the Amazon region often represents the only connection to an urban reality for rural residents and those living in impoverished villages and towns.

A distinct characteristic of these regional, sub-regional and local urban networks in the Amazon is the strong link between rural and urban areas, and the “forest identity” found in some cities (Guedes *et al.* 2009). For instance, Padoch *et al.* (2008) affirm that “the new urbanites’ maintenance of ties to rural homes and persistence of rural preferences, tastes, and housing patterns, have been in some senses a “ruralization” of Amazonian cities. There are other indications of the significant influence of linkages between rural and urban areas in the Amazon, such as the crucial role of house-lot gardens to social networks, subsistence and food security (Winklerprins, 2002) and the açai fruit’s (*Euterpe oleracea* and *Euterpe precatoria*) importance in urban markets not only as a “fashion” food, but also as a staple for rural migrants and low income populations.

The Case of Acre

The state of Acre covers 153.736 km² and represents 3.2% of the Brazilian Amazon. The state has a particular history within Brazil and the Amazon region. It was originally considered a territory by the Brazilian government after its annexation from

Bolivia in 1903 following a dispute over the rubber production. The rubber economy was established through federal policies for migration from other Brazilian regions, especially from the northeast, a region of the country with extreme poverty and a predominantly dry climate. Arriving at Acre, these migrants encountered a rigid and abusive system in which they were exploited by owners of vast land holdings and on whom they were dependent for on almost all resources while working in remote areas inside the forest (Franca, 2009).

The forests of Acre are very rich in rubber trees (*Hevea brasiliensis*) which are scattered throughout the landscape. This species has been a protagonist in the history of the state. Patterns of urbanization and migration accompanied the crisis of the rubber production. The first outbreak of hunger, deprivation and consequent migration was suffered in the 1910s when Brazilian rubber, a product of extractivism, was unable to compete with the cheaper rubber produced in Malaysian plantations in the international markets. There was also a period of revival in Brazilian rubber production during World War II, with Malaysia blocked from providing rubber to North America by the Japanese; the production in Acre was briefly reestablished and rubber tappers gained the denomination of “rubber soldiers” (Franca, 2009).

Although the history of Acre was marked by migrations, Schmink and Cordeiro (2008) affirm that the late 1970s represented a rupture in Acre’s history with massive migrations from rural to urban areas and the peak of migration to Rio Branco, the state capital. This increase in the degree of urbanization in the state of Acre can be seen in Figure 1-3, a result of the accelerated selling of land plots to investors from the south of Brazil thereby changing social relations and tenure systems. With the decline of the

rubber system, many *patrões* (concession owners) lost or abandoned their lands, and many rubber tappers became autonomous merchants or also abandoned their lands, migrating in large numbers to urban centers (Schmink and Cordeiro, 2008).

Inequalities in the Amazon were reinforced by this transformation since the elites owned valuable resources while the majority of the population was marginalized. In the empty economic and political space left by the decline of the rubber system, a new economic and political scheme emerged for the Amazonian region against the agrarian settlement for colonization models and massive industrial projects proposed by the federal government. The proposal of a development strategy based on the sustainable use of the forest emerged from social movements composed mostly by rubber tappers (Schmink and Cordeiro, 2008) that have been conquering power in the political scenario of the state since the early 1990s.

The background scene of this study of change in fruit consumption patterns is composed by this historical development, in which urbanization and a grassroots emergence of a new political model for development have been taking place. Acre is in a frontier region where global, regional and local interests are often conflicting, but where there are opportunities for innovation in the socio-political scenario. Therefore findings related to drivers of transformation in consumption of regional fruits and distribution systems are a valuable source of information for governmental and non-governmental agencies, to address issues of development, such as biodiversity conservation, food security and population health, particularly focusing on long-term sustainability.

Limitations

To assess the effects of urbanization and the reasons behind changes in regional fruit consumption in the Amazon it is necessary to operationalize these processes, which represented a difficult task. For instance, one way of measuring urbanization is to use the ratio between the urban and the total population from an area, but this measure of the urbanization is an instant picture of a fluctuating migration process which has been occurring for the past few decades for different reasons. Therefore, ideally in such a study, panel data would be collected, interviewing the same population throughout time and monitoring reasons for migration. However, for the scope of this study, and considering time and financial resources, alternatives to these approaches were used and their limitations are discussed as follows.

The main research questions of this thesis are: how is urbanization changing food diet systems for regional fruits in the state of Acre? Does the diversity of regional fruit consumption differ considering residents of municipalities with higher and lower degrees of urbanization in the state of Acre? Despite the limitations described above for the use of urbanization degree as a variable, this ratio is used in this study to compare municipalities, yet bearing in mind the historical development of the state. In addition, with the limitation of no previous information on regional fruit consumption patterns available, the East and West of the state were compared as a proxy for the urbanization process. The East represents the most developed urban agglomerate with a number of paved roads, connections to other parts of the countries and where the state capital is located, with services being a very significant part of the economic activities, whereas the West of the state, another urban agglomerate where the second largest city is

located (Cruzeiro do Sul) is still predominantly isolated without permanently paved roads connections and a greater proximity to the rural and forest environment.

There are two other very important limitations considering the study of regional fruit consumption. The first limitation is related to the definition of the term “regional fruit” since the mass population in general did not distinguish the consumption of native and exotic fruits, considering that many fruits are native to the Amazon but not necessarily to the ecosystems found in Acre and also many exotic fruits have been cultivated in garden lots in rural and urban areas for such a long period of time that they are considered part of their food culture. It is also important to point out that agricultural areas in the Amazon, including where these fruits are cultivated, are areas that were once forested.

Because of these reasons the definition for regional fruits in this study was: native fruits to the Amazon and exotic fruits which have been widely cultivated in the region and were produced either in the state of Acre or in the neighboring states (still part of the Amazon ecosystem). Since not all consumers knew the origin of the fruits they consumed, it is likely that some fruits were coming from other farther states in the southeast, and were considered regional because they could be grown in the Amazon region. However, to the extent possible (in the case of vendors, most of them knew the origin of the product), the origin of the fruits consumed was investigated.

Moreover, seasonality may also represent a problem in studies of regional fruits. Most tropical fruits are harvested in the wet season, although this is by no means a rule and the fructification period may vary from a few months, even exclusive to the dry season in some species, to year-round. The production period also varies with location,

and since the Amazon region is heterogeneous it certainly varies among states. For instance, the production period of açai in the state of Acre has been mentioned as year round (SUFRAMA, 2003), also, for patauá (*Oenocarpus bataua*) the fruiting period extends throughout the year, with production peaks in March and May. However, for buriti (*Mauritia flexuosa*) in the Western Brazilian Amazon, this period is restricted to the months of August through February (Machado, 2010). For the fruits that are not extracted from the forest but are cultivated in the state, there is also a lot of variation, for example, cupuaçu (*Theobroma grandiflorum*) has an extended harvesting period of eight months in a year reaching its peak in February and March (EMBRAPA, 2001), however graviola (*Annona muricata*) and pupunha (*Bactris gasipaes*), depending on the varieties, may produce for a maximum of around three to five months in a year (EMBRAPA, 1999 and SEBRAE, 1995).

The regional fruits analyzed in this thesis are seasonal and may only be producing during a certain period of the year. Considering that the data were collected during two months, the findings of diversity should be comparable among consumers, as they were all asked about a period of seven days consumption. However, the numbers collected do not represent an absolute value for the diversity of regional fruits consumed by an interviewee. For vendors, the data on diversity of fruits sold are more accurate since they have been collected not only using market observations, but also interviews in which these knowledgeable individuals recalled or had a formal record of the types of fruits sold in their establishments throughout the year.

Given these limitations, in the next chapter the main research question will be explored as well as the distribution system of regional fruits. Considering differences in

urbanization, specific questions will be addressed, such as: where are regional fruits obtained by the urban population? Which markets hold regional fruits? Does the variety of regional fruits available differ by market types? Chapter 3 will then explore lifestyle factors behind consumption such as the role played by income, sex, gender and the possession of garden lots, comparing residents of larger cities and smaller towns.

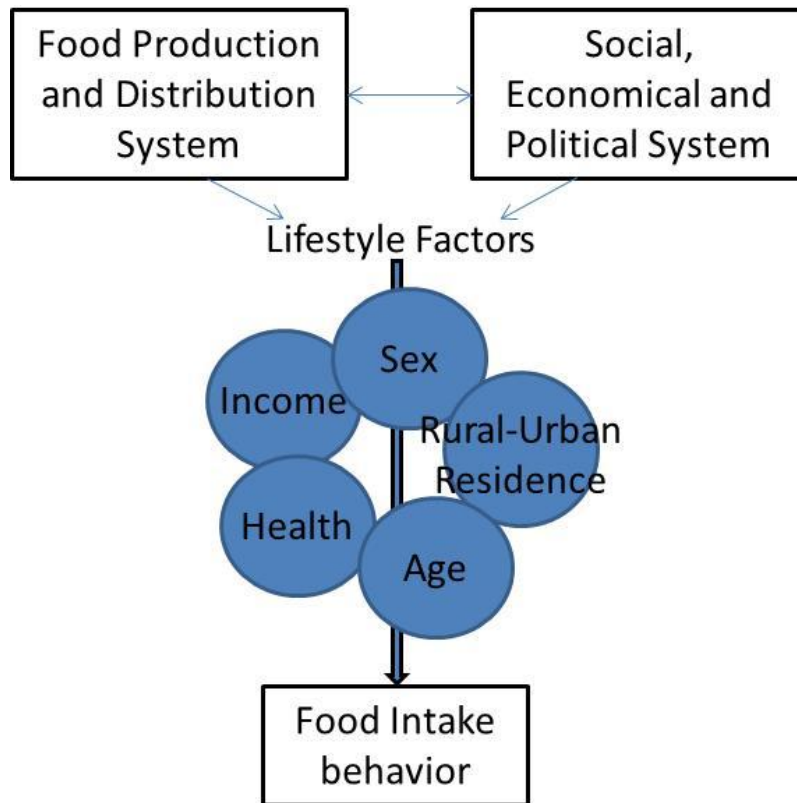


Figure 1-1. Food intake behavior operational model, adapted from Pelto (1981)

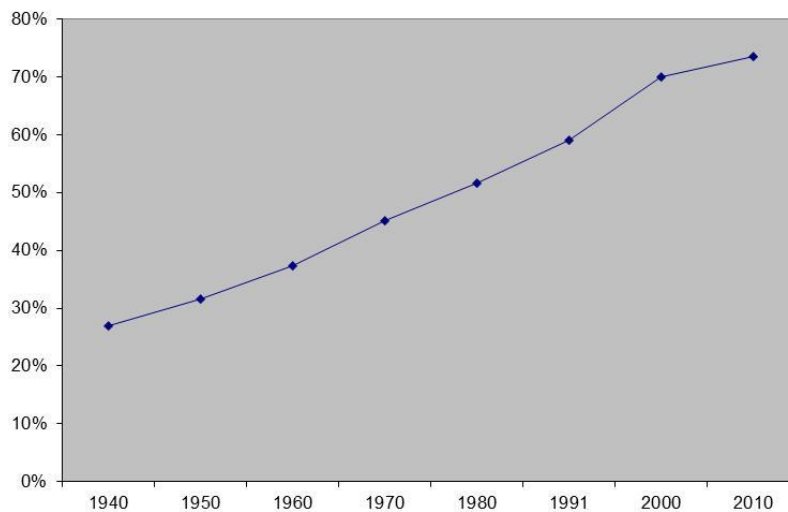


Figure 1-2. Urbanization ratio in Brazilian Northern region, 1940-2010 (IBGE – demographic census 1940-2010 and population count 1996)¹

¹ Data from 1940-1980 does not include Tocantins state. The state was created in 1988 out of the northern part of Goiás state.

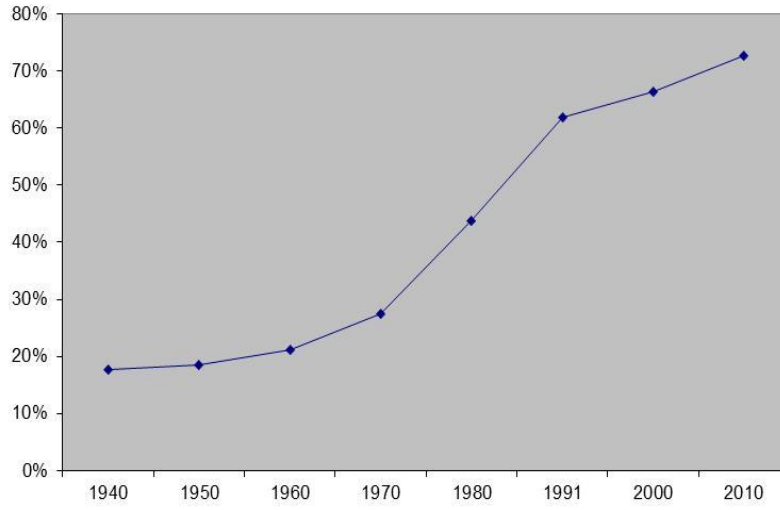


Figure 1-3. Urbanization ratio in Acre state, 1940-2010 (IBGE – demographic census 1940-2010 and population count 1996)

CHAPTER 2 CHANGES IN MARKETS OF REGIONAL FRUITS IN THE AMAZON

Urbanization and Market Dynamics

The aim of this chapter is to analyze urban centers from a market point of view, but with an emphasis on the social and cultural characteristics shaping local markets and vice-versa. This chapter looks at the availability of regional fruits in markets ranging from more traditional open markets to modern supermarkets, and potential impacts of urbanization on the distribution systems directly affecting consumption of regional fruits.

Despite the abundance of tree fruits and the nutritional and cultural importance of tropical fruits in the Amazon region, their local production and sales have not received much attention as an economic activity. In the most recent ecologic-economic zoning of Acre, concluded in 2006 by the state government (ACRE, 2006), the productive structure of the economy was ranked according to gross domestic product (GDP) contribution to the state, classified as services (66%), industry (28%) and farming - including agriculture and cattle ranching- (6%). Although the ecologic-economic zoning includes a brief analysis of non-timber forest products, recognizing its importance to the region, there are no data on the production or selling of açai fruits, for example, which could be considered a significant forest and an agricultural product in the internal and external market.

Moreover, the Brazilian Institute of Statistics and Geography (IBGE) reports on national fruit production by state do not include any of the traditional Amazonian fruits, such as açai, cupuaçu and pupunha. The state of Acre is responsible for less than 1% of Brazilian fruit production for all the ones considered in the IBGE data, except for bananas, that represented 1.3% of the country's production. Of course, these low

numbers reflect the small size of the state, corresponding to only 1.8% of the official area of the Brazilian territory (IBGE). On the other hand, IBGE has produced reports on extractivism and forestry production, with numbers for the production of açaí since 2004, and although these numbers may be underestimated, considering that the product has no taxes applied and often does not reach formal markets, the production seem to be increasing in the state of Acre (from 741 tons in 2004 to 1658 tons in 2009), although it is minuscule compared to the major state producer in the country, Pará (Figure 2-4).

In addition, estimates based on commercial data, show that from the late 1980s to the middle 1990s the consumption of açaí pulp doubled in the capital state of Pará, going from 200 to 400 thousand liters per day, which by then represented twice the consumption of milk in the same city (Rogez, 2000).

Many people living in Amazonian cities use forest products in their work activities, transforming products such as timber, fruits, herbs and seeds. Additionally, in the peri-urban areas, activities often depend on the use of agroforestry systems and on combining agriculture with extractivism. In general, these activities are not recognized in official financial accounts, or are only partially recognized, although they contribute to the local and regional economy (Castro, 2008) and have the potential to increase food production in the state, which is not self-sufficient.

In a publication about Brazilian urban networks by IPEA (2001), the authors argue that in the 1990s there was a shift in the model of development in the northern region, from a focus on the internal market, with the government giving incentives to develop the local economy, to a model of connecting state economies, giving priority to the

export of key products. Shifts such as this, occurring under increasing demographic and economic pressures, amplify concerns for the future of agrobiodiversity conservation and traditional home gardens. In areas of high urbanization, home gardens are becoming an important strategy for making cities more sustainable, improving local economy, providing healthier food and reinforcing cultural identity (Galluzzi *et al.*, 2010).

Few studies have been conducted on changes in local markets in the Brazilian northern region and their consequences. Still, variations in food cost and availability combined with socioeconomic changes have the potential to cause and/or reinforce health inequalities (Latham and Moffat, 2007). For instance, one study from Canada showed that when healthy foods such as fruits and vegetables were not locally available, the population tended to shop at self-service stores where food typically was more expensive and had higher content of fat and sugar (Latham and Moffat, 2007). Another study conducted in Canada showed the benefits of the introduction of a farmer's market in a particular neighborhood, increasing the availability of healthy food and lowering overall food costs for households (Larsen and Gilliland, 2009).

Markets have been seen as an important resource for conservation of non-timber forest products (a denomination that includes native fruits), as an alternative to aggressive timber extraction or other more degrading land use activities. Belcher *et al.* (2005) assume that for forest products to contribute to poverty elimination— that is, to lift people out of poverty— they must generate a surplus beyond current consumption needs, implying that the products must be traded to ensure development. On the other hand, several authors have criticized a pure market based perspective for conservation and development. For instance, in the case of Belém's trade of non-timber forest

products in the Eastern Amazon, Shanley *et al.* (2002) call this market-base strategy a “faint promise”. Based on market survey data they demonstrated that the reality for many smallholder communities in frontier and remote regions includes chronic transportation difficulties, high variability in fruit production, perishable products and lack of market expertise. In more urbanized areas, marketing of NTFP has led to overexploitation of resources, although there are a few cases in areas close to cities, where transportation is assured and smallholders are overcoming these obstacles, successfully managing and trading native fruit and medicinal species (Shanley *et al.* 2002).

Moving to a more general view of food markets, McCullough *et al.* (2008) identify three main trends in developing countries: the advance of modern food supply chains due to global exposure, competition and investment while traditional chains risk stagnation due to underinvestment; a rising need for coordination (ensure communication of product origin and consumer demand information), reducing but also introducing costs; and income growth and urbanization (rising female employment and increasing exposure to different types of foods) are associated with shifting consumption to more diverse diets that are higher in fresh produce and animal products and contain more processed and pre-prepared convenience foods (higher value products displacing food staples). Surely, these processes are occurring concurrently.

Considering the rise of supermarkets and their rigorous standards and demands on suppliers, a number of studies emphasize negative effects for consumers and smallholder farmers, with survival of traditional retailers restricted to niche markets (Reardon and Berdengué, 2002). Supermarket share rises were explained mainly by

urbanization and GDP growth in projections made by Traill (2006), suggesting that supermarket's share of the retail food market will reach 76% in Brazil by the year 2015, one of the highest increases among Latin American countries.

However, a few studies conducted in Brazil suggesting a different picture, where traditional traders are able to coexist with modern retailers, especially because of traditional food habits persistence and fresh products availability in traditional retailers. For instance, while looking at open markets in São Paulo, Zinkhan *et al.* (1999) emphasize how open markets foster social relationships, with consumers engaging in conversations and becoming loyal to particular vendors. They argue that traditional markets are not necessarily supplanted by supermarkets, but that market formats often coexist, innovating and adapting, according to consumption patterns and local preferences. Moreover, Farina *et al.* (2005) analyzed the number of stores in Brazil from 1994 to 2002 classified as chain, independent and traditional retailers, concluding that they tend to coexist mainly due to consumers' willingness to pay more for the convenience offered by smaller and traditional retailers. Interestingly, while analyzing the data among different regions, results were not homogeneous, and there were no data shown for the northern Brazilian region. One of the few evidences of the coexistence of different retailers in the Amazon region can be seen in a study conducted from 1989 to 2004 by Schmink and Cordeiro (2008) in the capital city of Acre, Rio Branco, showing an increase in the number of supermarkets establishments by 25.5%, but also in street markets by 12.5%.

Despite poverty, urban consumers have shaped market dynamics significantly through change in consumption patterns for forest products in the Amazon and studies

addressing local markets and staple foods are lacking. For instance, the consumption of açaí has changed culturally from a predominantly rural habit, until the 1970s, to being currently largely consumed in urban households, mirroring urbanization rates (Padoch *et al.*, 2008).

Ties to the forest or to rural environments are particular to the urbanization process in the Amazon. Moreover, specifically in the state of Acre there has been an effort to promote development combining the sustainable use of forest resources with modern expansion. These particularities are embedded in the social, economic and political system which represents a framework for this study of food culture. In this distinct context, where are regional fruits obtained? For instance, urban forest fragments and urban garden lots may have an important role. Which markets hold fresh regional fruits? Is there a difference in availability among supermarkets and open markets, for example? Are supermarkets supplanting open markets? Does the availability of regional fruits differ from more urbanized to less urbanized centers? These are the specific research questions analyzed in this chapter.

Research Site

The state of Acre was selected for this research largely because it is a Brazilian state characterized by a culture of development which has taken different paths compared to other regions of the Amazon forest. These paths are related to a history of the fight for land rights and forest conservation, personalized in the figure of the rubber tapper movement leader Chico Mendes (murdered in the town of Xapuri in 1988) during the 70's and 80's, as well as the more recent “florestania” ideology, basically translated as a citizenship embedded with a forest identity.

Moreover, the state of Acre was strategic for a study on urbanization since it can be divided in two main “network segments,” primarily based on the sequence of cities along the Juruá and Tarauacá watersheds integrating a drainage network and as a result of the spatial distribution of the population, geographic features, and occupation history (IPEA, 2001). This division corresponds to urban agglomerates in the east and west of the state, around the two largest urban centers; Rio Branco, the state capital, and Cruzeiro do Sul, in the west.

The definition of urbanization used in this thesis was based in three components:

- Ratio urban/total population (referred in the text as degree of urbanization);
- Size of urban centers;
- Isolation and unpaved roads.

Six Acre municipalities were selected as research sites because of their similar degree of urbanization, proximity to large cities and geographic location. Three municipalities were located in eastern Acre, an intensely urbanized region with strong trade links to the rest of Brazil, and the other three in western Acre, a region practically isolated for six months every year during the rainy season (Figure 2-4. Açaí production in tons per year at Acre and Pará state (2004 to 2009) - IBGE.

Figure 2-5).

The largest cities in the state of Acre, Rio Branco and Cruzeiro do Sul were paired, as well as Mâncio Lima with Xapuri, and Rodrigues Alves with Porto Acre and the comparison patterns between these paired urban centers and between the east and west regions were used as proxies for urbanization differences (Table 2-1).

Combining Quantitative and Qualitative Methods

Interviews were conducted in food stores which were classified according to the definitions of Reardon and Berdengué (2002) of four types of food retailers in Latin

America: small full-service stores (not in chains), traditional markets (street markets or permanent), small self-service stores (tend to be in chains), and large self-service stores (supermarkets or hypermarkets). More specifically, supermarkets were considered as the ones having three or more cash registers, as used in most market studies found in the literature (Traill, 2006).

The goal was to understand changes in regional fruit consumption, not only purchased fruits, but also gathered from other sources such as exchange with relatives; therefore the interviews were conducted in stores selling a variety of goods, whether or not they sold regional fruits. It is important to note that data were collected on the different types of regional fruits available in markets regardless of quantities. The result on the diversity or variety of fruits available in markets was based on observation and interviews with vendors.

A broad definition of regional fruits was adopted for this paper including native and exotic species. The exotic fruits considered were the crops well adapted and relevant to the Amazon -such as banana (*Musa sp.*), mango (*Mangifera indica*) and bread fruit (*Artocarpus altilis*) - grown within the state of Acre or in neighbor states (Rondônia and Amazonas). Although the exotic plants do not represent ties to the forest, they represent ties to a rural environment, and many are significant in home gardens and markets. To the extent possible (not all vendors knew the origin of the fruits sold) fruits that are well adapted to the region, but always came from distant states, such as São Paulo and Paraná, were not considered as regional.

A list of the main markets in the urban centers was gathered based on governmental data and preliminary interviews with vendors. From this list in each urban

center, locations were randomly selected. In the case of traditional markets with more than one vendor, the majority of vendors were interviewed; the main goal was to determine the number of different types of regional fruits sold. A list of common names and scientific names of all regional fruits mentioned by vendors in each urban center, and how they were classified, can be found in Appendix.

The number of interviews with consumers was calculated based on a probabilistic equation for large population sizes, yielding representative samples for proportions (Cochran, 1963). The data were analyzed using the Statistical Package for the Social Sciences (SPSS) software descriptive statistics, determining statistical significance based on chi-square statistics when analyzing two categorical variables, and analysis of variance when involving continuous variables.

In order to attain a relatively random sample, consumers were interviewed in markets as they came to shop for goods. Each interview took an average of 15 minutes, although the amount of time spent on each interview varied a lot since they included survey questions and open-ended questions. A total of 276 interviews were conducted with consumers (urban residents or multi-sited residents) in urban centers of the six municipalities selected (from May through July, 2010). A total of 82 interviews were conducted with managers or employees responsible for fruit and pulp sales in markets, to identify the diversity and availability of fruits produced within the state of Acre (Table 2-2).

Vendors were asked about which fruits were sold throughout the year and their origin, market strategies and problems. Consumers were asked about their diet habits and reasons for changes related to their consumption of regional fruits. They answered

questions such as: Which fruits did you consume last week? How did you get them (purchase, exchange with relative and friends, gathered from forest fragments)?

The research design for the qualitative analysis followed the guidelines given by Rubin and Rubin (1995), being flexible (for example, new themes related to food consumption emerged during interviews, potentially pointing to an unexpected line of reasoning that had to be incorporated in the design of the next interviews), iterative (limiting interview responses gradually) and continuous (redesigning the questioning throughout the project). Interviews with consumers were conducted until reaching the stage of theoretical saturation, at which point further information fails to offer new explanation for changes in consumption patterns and to add significant ideas to the themes involved in the main questioning.

Findings: Regional Fruit Consumption and Market Trends

Urbanization has impacted the availability of regional fruits in different types of markets. The differences identified were divided in two levels:

- Cross-regional, meaning that a difference was observed between east and west;
- Intra-regional, meaning that a market trend was observed between urban centers varying in size within the eastern or within the western region of the state.

One simple approach to look at the effects of urbanization on the consumption of fruits was to compare answers of consumers about the number of fruit types consumed in a week. A cross regional analysis shows that the process of urbanization seem to be associated with a lower diversity of regional fruits consumed, since there was a statistical significant difference between respondents living in the eastern (more urbanized) and western (less urbanized) region of the state (Table 2-3).

Indeed, comparing the same data from an intra-regional point of view, this difference in consumption can only be seen in the eastern region of the state, where in urban centers with a higher degree of urbanization, the diversity of fruits consumed is lower. In the capital of Rio Branco the consumption was lower than in Xapuri and Porto Acre (Table 2-4), but in the western part of the state, consumption among the three urban centers of varying sizes was very similar (Table 2-5).

This finding suggests that the urbanization process in the eastern part of the state in particular reduced consumption of regional fruits and that the degree of urbanization and how it takes place can undermine the consumption of regional fruits.

Availability of Regional Fruits in Supermarkets and Open Markets

In the two largest cities of this study located in the east and west region of the state supermarkets were present and represented a major location for the whole population to shop for food: 80% of interviewees in Rio Branco and 97% in Cruzeiro do Sul mentioned supermarkets as the usual place for shopping. This was a significant intra-regional urbanization trend since supermarkets have not reached any of the smaller towns studied, in eastern or western Acre. It is notable that in an urban center such as Cruzeiro do Sul supermarkets are predominant for purchase of goods, given that the city is practically isolated for six months due to road conditions during the rainy season, with extreme difficulty of access to products from outside regions.

In Cruzeiro do Sul, however, fresh regional fruits are still found in supermarkets, while in Rio Branco, where isolation is not such an important issue, fresh regional fruits could not be found in them. Therefore, the lack of fresh regional fruits available in supermarkets is a cross-regional urbanization difference whereas the presence of supermarkets is an intra-regional effect, found in the east and west of Acre state (Table

2-6). A list of the fresh regional fruits found in supermarkets and open markets in the two largest cities of the state are shown on Table 2-7.

Furthermore, there seems to be higher diversity of regional fruits in open markets located in larger cities, compared to smaller town's open markets. Open markets in Rio Branco had a much higher diversity of regional fruits compared to markets in Xapuri and Porto Acre. On the other hand, for Cruzeiro do Sul, Mâncio Lima and Rodrigues Alves, the three urban centers studied in the western region of the state, the number of types of regional fruits available at open markets was very similar (Table 2-6).

In the eastern part of the state, vendors sent the regional fruits collected or produced in smaller towns to the state capital, leaving the population in the smaller towns without the option to purchase regional products locally. A higher diversity of fruits were available in markets of Rio Branco mainly as a result of the greater number of consumers with high purchase power in this city, willing to pay more for regional products. In the western region, where urbanization was less intense, the influence of Cruzeiro do Sul did not seem to be as great, and regional fruits were still available in open markets, independent of the municipalities' degree of urbanization. However, other factors such as distance from major urban centers and history of crop production in the municipality also play a role in the availability of fruits in markets. Moreover, garden lots, exchange of fruits with relatives and forest fragments are also sources for regional fruit consumption which do not involve purchase.

Fruit Pulp Entering Markets

A number of tropical fruits are traditionally consumed in the form of pulps in the Amazon region. The most common examples are açaí and buriti, however many others, such as cupuaçu and graviola, are usually consumed as juices also made from pulps.

An interesting trend in markets is related to the availability of these fruit pulps. The number of fruit pulps available in markets was higher in larger cities compared to smaller towns in the eastern and western part of the state, therefore characterizing an intra-regional urbanization effect. Regarding the types of markets reached, fruit pulps were found not only in open markets of larger cities, but also in supermarkets. In contrast, smaller towns do have regional pulps available for purchase, but only made of a few different fruits (Table 2-8). A list of the regional fruits, in pulp form, found in supermarkets and open markets in the two largest cities of the state is shown in Table 2-9. All fruit pulps in supermarkets were frozen except açai pulp which was refrigerated, reflecting consumers' preference for fresh or refrigerated pulps, especially of fruits that are very traditional in some regions such as açai and buriti. At the same time, it shows how supermarkets are adapting, to some extent, to local preferences.

All pulps found in open markets were homemade whereas in supermarkets they were all industrialized (Figure 2-6 and Figure 2-7), produced by IT polpas, Ki-legal, Só Frutas, Frutos da Amazônia, Açai de Feijó and COOPERACRE - in Rio Branco - and Frutas Sid in Cruzeiro do Sul. Supermarkets impose more rigorous quality and logistical criteria on their suppliers, such as regularity of product supply throughout the year (even for fruits out of season) and product registration in the Ministry of Agriculture. Therefore, refrigerated or freshly squeezed were found more commonly in open markets, where they do not necessarily need to follow such requirements.

Traditional Markets in Larger Cities

Considering the type of markets, in general, it was clear that open markets were the main source for purchase of different fresh regional fruits, again independent of the degree of urbanization in the municipalities. This finding emphasizes the importance of

changes in open markets for the consumption of regional fruits and for the attainment of benefits this may bring to the urban population.

For instance, In Rio Branco and Cruzeiro do Sul, traditional permanent open markets were becoming commercial centers, changing from selling vegetable and fruits to small full-service units to selling industrialized goods, electronics or services, with the proliferation of hairdressers, small restaurants and electronic repair shops. This trend was observed more dramatically in Rio Branco, where from the list of seven permanent “open markets” gathered in the Secretary of Agriculture, only one, the central market, kept on selling mainly fruits and vegetables. One excerpt from an interview with a vendor exemplifies this trend: “Here, the product that sells more is dog food, but we also sell some vegetables. Açaí we simply have to have, so that if the person wants it too, we have it” (vendor I, Estação open market).

On the other hand, eleven organized neighborhood street markets spread throughout Rio Branco in low income and high income neighborhoods. In these markets, vendors were either producers or simply vendors buying products for sale in other locations in the city (mainly the central open market or in a new distribution center). Vendors in neighborhood street markets mentioned many problems, especially lack of support from the government, for example with structures for selling the products and transportation of goods. These open markets were organized on a weekly basis, some were very small, composed of only two vendors, but others, such as the organic open market in downtown Rio Branco, gathered more than 30 vendors, attracting a vast number of consumers on Saturday mornings.

All urbanization trends discussed in this section are summarized on Table 2-10 using the same division of levels, cross-regional (difference observed between east and west) and intra-regional (difference observed between urban centers varying in size within the eastern or within the western region of the state). The predominance of cross-regional differences shows that impacts on markets differ between East and West of the state. In the more urbanized eastern region, the lack of fresh regional fruits in supermarkets, permanent open markets becoming commercial centers, organization of street markets and higher diversity of regional fruits in open markets are pronounced

Invisible Sources of Regional Fruits

So far only food markets have been mentioned as sources of regional fruits in urban areas. However, regional fruits are also obtained from urban residents' garden lots, from parents or relatives living in rural or urban areas, or extracted from forest fragments still present in urban centers. Sources of regional fruits were classified as "visible consumption" - fruits purchased in markets- or "invisible consumption" –fruits obtained in home gardens, exchanges with relatives and friends, and collected in urban forest fragments. The term "invisible" consumption was chosen because of the lack of recognition of the consumption of fruits from home gardens and urban forest areas by the interviewees, compared to the instant recognition of purchased fruits. Moreover, vendors would identify the opportunity of selling regional fruits available in home gardens, but would not venture to do so, often affirming that they were not meant for sale. For instance, a vendor mentioned she was ashamed of selling coquinho urucuri (*Attalea phalerata*) because of a prejudice of some people who would argue that the fruit was not meant for human consumption, but only for animals. At the same time, the

vendor was aware of a demand for this fruit in the market, but still did not show interest in selling it.

The Use of Urban Forest Fragments and Garden Lots

Urbanization affected access to regional fruits in different ways, considering regional fruit consumption from invisible sources. For instance, the use of forest fragments for the attainment of fruits was mentioned only by consumers living in the western region of the state (Table 2-11) which reflects the lower number of forest fragments still present in urban centers in the eastern region, compared to the other side of the state. It was also expected that in less urbanized western region forest fragments would be more preserved, and therefore consumption of fruits from this source would be higher comparing small towns to large cities.

Mâncio Lima, in the western region, showed an outstanding number of people (11 or 22% of interviewees) making use of forest fragments, especially because of the number of *buritizais* still preserved within the urban center. The urban population in small towns collect fruits in forest fragments, not only for consumption, but also for occasional fresh pulp sales, adding to their income. These fragments cannot be found any longer in larger cities like Rio Branco, where, for instance, nobody mentioned it as a source for regional fruits consumption.

Moreover, despite the fact that garden lots are very common in households throughout the Amazon cities, there was, again, a significant difference between the possession of garden lots by interviewees in the east and west regions of the state of Acre (Table 2-12). It was yet again expected that people would have less garden lots in larger cities than in small towns, and the reasons behind this trend will be discussed in the following chapters.

Fruit Exchange Networks

Another invisible source of regional fruits was the donations or exchanges of regional fruits between relatives and friends living in rural or urban areas. Among the fruits mentioned were: cupuaçu, passion fruit, coconut, buriti, carambola, guava, ingá, papaya, urucuri, graviola, açaí, cashew, banana, bacuri, pupunha, and cacao. Interestingly, Rio Branco, the larger city in this study and Rodrigues Alves, one of the smallest towns in this study, were the two urban areas where most interviewees mentioned this source for regional fruit consumption (Table 2-13). This trend shows that fruit exchange networks may play an important role at the extremes, locations with very high or very low urbanization contexts.

The exchange of regional fruits is much higher in the eastern more urbanized region than in the western part of the state (Table 2-14). This difference in the exchange of fruits is intriguing since people engaging in this practice were mostly residents of urban centers in the eastern part of the state and, as shown on

Table 2-3, which is where a lower diversity in the consumption of regional fruits was found. Is the exchange of regional fruits a strategy practiced by the low income population to enhance their access to these products? Or is it not related to income, but to the recent social origin of the residents, as a practice brought from rural settings? These are some of the issues explored in the next chapter dealing with individual characteristics or lifestyle factors behind changes in consumption of fruits.

Closing remarks on urbanization and distribution system

Urbanization seen through the lens of food markets reveals a mixed picture of changes in the availability of regional fruits. Supermarkets are gaining space rapidly in large urban centers and tend not to incorporate fresh regional fruits. Perhaps because

of this lack of supermarkets incorporating such products, open markets do not seem to be intensely threatened by this growth of supermarkets in larger cities. In fact, it was in open markets of larger urban centers that a higher diversity of fresh regional fruits could be found and again, it was in the largest city considered in this study that an initiative arose of organizing neighborhood street markets selling regional products.

Nevertheless, I argue that the main consequence urbanization brings to markets is to direct regional fruits, collected or produced in small towns, to large cities where consumers pay higher prices for these items. One possible consequence of the market trends is that rich consumers are more likely to have access to fresh regional fruits, and specially frozen pulps which are reaching all market types from supermarkets to open markets with high prices. These frozen pulps, however, do not represent the traditional way of consuming most of these regional fruits. Evidence of this preference is the trial done in some supermarkets of incorporating refrigerated pulp of açaí, one of the most traditional fruits in this region.

Despite the higher diversity of fruits found in larger cities in the eastern region and fruit pulps reaching supermarkets, the consumption of regional fruits is still higher in the western part of the state, where the degree of urbanization is lower. One possible explanation is the importance of invisible sources of regional fruits such as garden lots and urban forest fragments which are more frequent in the western region, more isolated and remote.

Clearly urbanization is affecting markets and the distribution system of regional fruits, including possession of garden lots, presence of urban forest fragments and the exchange of fruits between relatives and friends. The way markets will develop to reach

consumers with different profiles depend on a number of factors such as the management of garden lots and urban forest fragments. Public policies, for example, are crucial to prepare producers to reach supermarket demands or to ensure the conservation of urban forest fragments in towns; also individual preferences change with urbanization and will continue driving markets and regional fruit availability in the future. Changes at the individual level are discussed on Chapter 3.

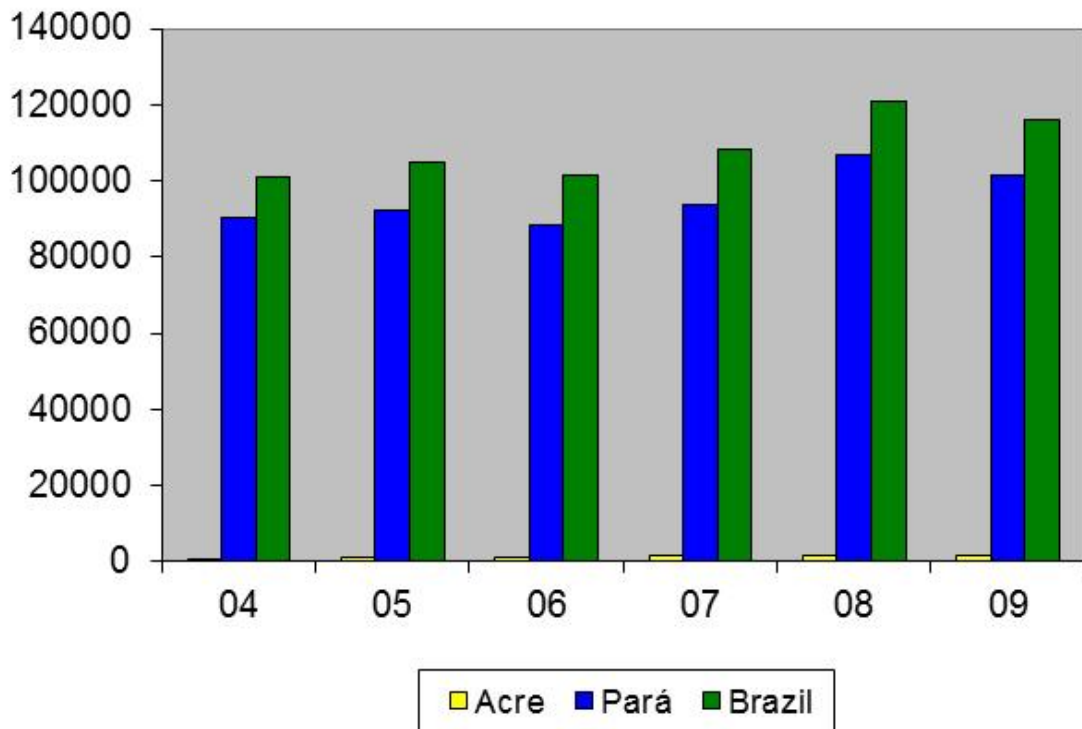


Figure 2-4. Açai production in tons per year at Acre and Pará state (2004 to 2009) - IBGE.

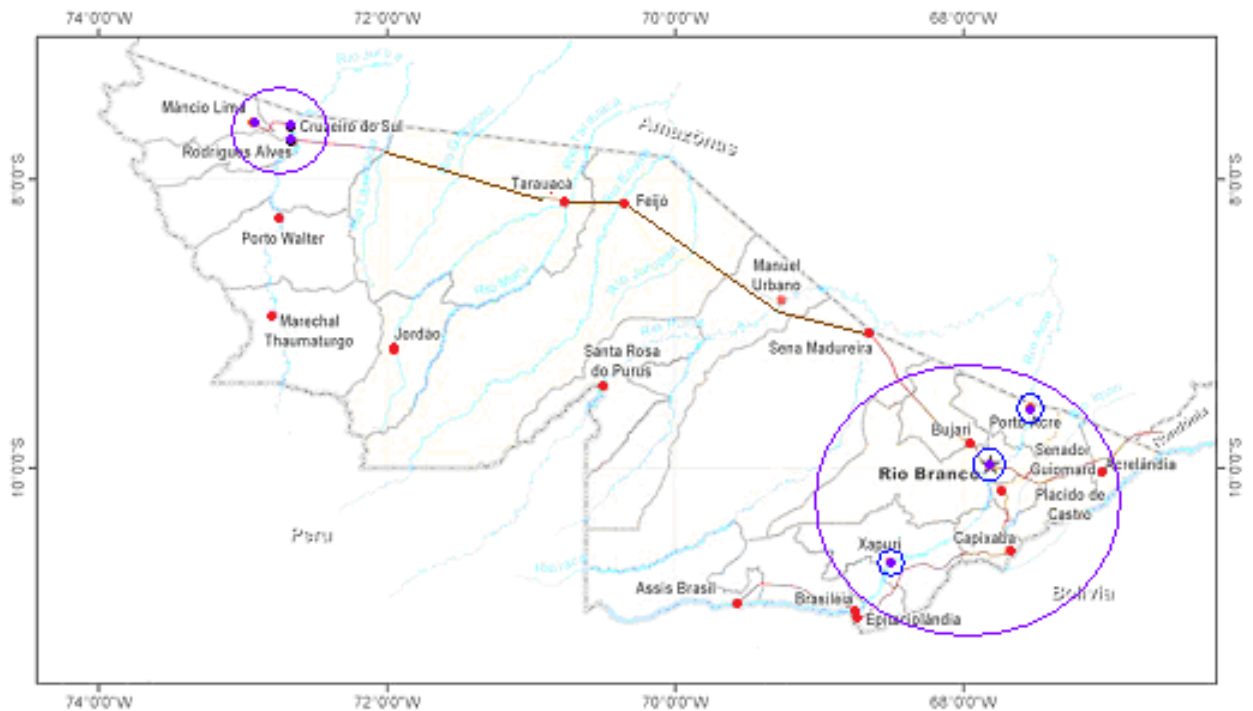


Figure 2-5. Map of Acre with the cities and towns visited highlighted (adapted from SEPLAN, 2009).



Figure 2-6. Patauá pulp sold in an open market of Mâncio Lima, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).



Figure 2-7. Açaí pulp sold in a supermarket of Rio Branco, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).

Table 2-1. Total population number and number of urban residents in municipalities in the state of Acre (ACRE, 2009)

Urban center	Total population number	Number of urban residents
Rio Branco	290639	269505
Cruzeiro do Sul	73948	50950
Xapuri	14314	7366
Mâncio Lima	13785	8164
Porto Acre	13716	1841
Rodrigues Alves	12428	3674
Total population of the state	655390	464680

Table 2-2. Degree of urbanization (SEPLAN, 2009) and number of interviews in six municipalities in the state of Acre

	Urban centers	Degree of urbanization	Number of interviews with consumers	Number of interviews with vendors
West: Alto and Baixo Acre region	Rio Branco	92.7%	88	48
	Xapuri	51.5%	44	7
East: Juruá region	Porto Acre	13.4%	11	3
	Cruzeiro do Sul	68.9%	58	13
	Mâncio Lima	59.2%	50	6
	Rodrigues Alves	29.6%	25	5
Total			276	82

Table 2-3. Number of different fruit types consumed in a week by interviewees in eastern and western Acre, 2010

	East		West		Total	
	Mean	N	Mean	N	Mean	N
Number of types of fruits consumed mentioned by interviewees	1.1	139	2.2	126	1.7	265

Note: $F = 55.059$; $ss = <.000$

Table 2-4. Fruit types consumed in a week by interviewees in eastern Acre, 2010

	Types of fruits consumed	
	Mean	N
Rio Branco	0.98	86
Xapuri	1.43	42
Porto Acre	1.36	11
Total	1.15	139

Note: $F = 3.57$; $ss = .031$

Table 2-5. Fruit types consumed in a week by interviewees in western Acre, 2010

	Types of fruits consumed	
	Mean	N
Cruzeiro do Sul	2.37	54

Table 2-5. Continued.

	Types of fruits consumed	
	Mean	N
Mancio Lima	2.02	49
Rodrigues Alves	2.39	23
Total	2.24	126

Note: F = .948; ss = .39

Table 2-6. Number of different types of regional fruits present in markets of urban centers in the state of Acre, 2010

Urban center	Number of regional fruits available in supermarkets	Number of regional fruits available in open-markets
Rio Branco	0	22
Cruzeiro do Sul	8	22
Xapuri	No supermarkets	12
Mâncio Lima	No supermarkets	19
Porto Acre	No supermarkets	No open-market
Rodrigues Alves	No supermarkets	18

Source: observation of markets and interviews with vendors

Table 2-7. Common names of different types of fresh regional fruits present in markets of Rio Branco and Cruzeiro do Sul, 2010

	Rio Branco		Cruzeiro do Sul	
	<i>Supermarkets</i>	<i>Open markets</i>	<i>Supermarkets</i>	<i>Open markets</i>
Fresh regional fruits mentioned by vendor/manager (coming from Brazil northern region)	None.	Banana, buriti, fruta-pão, cajarana, cupuaçu, avocado, watermelon, mango, coconut, urucuri, papaya, passion fruit, pineapple, cacao, different types of citrus, graviola*, biribá*, abiu*, ingá*, pupunha*, jambo*, and tucumã*.	Banana, papaya, watermelon, passion fruit, pineapple*, citrus, graviola* and cupuaçu*.	Abiu*, pineapple*, avocado, banana, biribá*, buriti, bacuri*, carambola, cubiu, cacao, cashew, cupuaçu, citrus, cajarana, graviola, ingá, jaca, papaya, marajá*, maracujá*, maracujá da mata*, pupunha*
Number of fresh fruits	0	22	8	22

* Not observed in markets, listed based on information gathered with vendors.

Table 2-8. Number of different types of regional fruits pulps present in markets of urban centers in the state of Acre, 2010

Urban center	Number of fruit pulps available in supermarkets	Number of fruit pulps available in open-markets
Rio Branco	13	13
Cruzeiro do Sul	13	10
Xapuri	No supermarket	1
Mâncio Lima	No supermarket	2
Porto Acre	No supermarket	No open-market
Rodrigues Alves	No supermarket	4

Source: observation of markets and interviews with vendors

Table 2-9. Common names of different types of regional fruits, in pulp form, present in markets of Rio Branco and Cruzeiro do Sul, 2010

	Rio Branco		Cruzeiro do Sul	
	<i>Supermarkets</i>	<i>Open markets</i>	<i>Supermarkets</i>	<i>Open markets</i>
Regional fruit pulps mentioned by vendor/manager (frozen or refrigerated)	Pineapple, acerola, cupuaçu, cajá, graviola, guava, passion fruit, mango, acaí, carambola, araçá-boi, cashew and cacao.	Acaí, buriti, bacaba, patauí, araçá-boi, cupuaçu, cajá, graviola, passion fruit, guava*, acerola* and cashew*.	Pineapple, açaí, acerola, cajá, cashew, cajarana, carambola, cupuaçu, graviola, papaya, mango, passion fruit and araçá-boi.	Araçá-boi, guava, graviola, cupuaçu, passion fruit, cajarana, cajá, acerola, buriti and açaí
Number of pulps	13	12	13	10

*Not observed in markets, listed based on information gathered with vendors.

Table 2-10. Summary of urbanization impacts on markets divided by local and regional levels

Cross-regional effect	Intra-regional effect	
	East	West
No fresh regional fruits available at supermarkets in the east	Presence of supermarkets in larger city	Presence of supermarkets in larger city
Open markets with higher availability of fresh regional fruits in larger city in the east	Higher diversity of frozen pulps in larger city	Higher diversity of frozen pulps in larger city
Organization of street markets in neighborhoods of large city in the east		
Permanent open markets becoming commercial centers in larger city		

Table 2-11. Use of forest fragments for fruit consumption in eastern and western Acre, 2010

	East		West		Total	
	N	%	N	%	N	%
Number of interviewees that mentioned the use of forest fragments	0	0%	22	16.7%	22	16.7%
Total	144	100%	132	100%	278	100%

Note: Chi-square =304.268; ss =<.000

Table 2-12. Possession of garden lots by interviewees in eastern and western Acre, 2010

	East		West		Total	
	N	%	N	%	N	%
Number of interviewees that possessed garden lots	92	75.4%	110	86.6%	202	80.5%
Total	122	100%	127	100%	251	100%

Note: Chi-square =256.142; ss =<.000

Table 2-13. Fruit exchange by municipalities in Acre, 2010

Urban centers	n (exchange)	N (total)	P (exchange/total)
Rio Branco	19	88	22%
Cruzeiro do Sul	4	58	7%
Xapuri	6	44	14%
Mâncio Lima	3	49	6%
Porto Acre	0	11	0%
Rodrigues Alves	6	25	24%

Table 2-14. Fruit exchange by eastern and western region of Acre, 2010

	East		West		Total	
	N	%	N	%	N	%
Number of interviewees that mentioned fruit exchange	25	17.4%	6	4.5%	31	11.2%
Total	144	100%	132	100%	276	100%

Note: Chi-square =256.142; ss =<.000

CHAPTER 3 THE DEMAND SIDE

Importance of Fruit Consumption Patterns in the Amazon

On the demand side, a key driver behind rapid changes in markets is the growth of the urban population which comes accompanied by a change in lifestyle (Neven and Reardon, 2007). Given the pace of urbanization in the Brazilian Amazon, it is crucial to understand these changes in lifestyle. Traditional food diets, including regional fruit consumption, also have a number of other symbolic aspects other than simply meeting daily nutritional needs. For instance, cultural behavior patterns are reinforced through food habits, and consumption can translate into the attainment of social needs for security, belongingness, status or self-realization (Lowenberg, 1970). In the Amazon, regional fruit consumption habits are certainly related to the forest or the rural environment, as many of the fruits traditionally consumed are extracted from the forests or have been widely cultivated in the region, becoming part of the people's diets.

In this chapter, individual characteristics behind the consumption of regional fruits are analyzed. First, is the consumption of regional fruits different in more urbanized and less urbanized centers? What are the factors behind individual choice in these different settings? Perhaps rural origin is a factor for consuming a higher variety of fruits, or the possession of garden lots. Then, it becomes necessary to understand who the people who have garden lots are. Health concerns may indeed be related to a higher or lower consumption of regional fruits; does urbanization have an effect on that? This chapter looks at “lifestyle” factors such as income, gender, rural-urban origin and possession of garden lots assessing how they interact in regions with different urbanization degrees, ultimately affecting regional fruit consumption.

In this study, fruits are considered as being part of one of the four basic food groups classified by The World Health Organization (WHO) and The Food and Agriculture Organization of the United Nations (FAO) which are: protein, dairy, cereals and grains, and fruits and vegetables that are classified according to the percentage of important nutrients they hold or by their health recommendations. This paper focuses on fresh fruits and fruit pulps. It is essential to include pulps in an analysis of fruit consumption in the Amazon region since many regional fruits are commonly and largely consumed by processing fruits to extract the pulp, such as for buriti, açaí, cupuaçu and graviola.

Fruits and vegetables have gained the status of “functional foods” in the last decade mostly because of the discovery of their antioxidant components, such as phenolic flavonoids, lycopene, carotenoids and glucosinolates, capable of promoting good health and preventing or alleviating diseases (Kaur and Kapoor, 2001). Moreover, fruits and vegetables are a major source of biologically active substances such as vitamins and secondary metabolites and their consumption remains globally insufficient, leading the FAO to recommend it (Poiroux-Gonord *et al.*, 2010).

A few popular and widespread tropical fruits have been extensively studied regarding their health benefits. One example is cacao, native to the Amazon, found to improve antioxidant status, reduce inflammation, and correlate with reduced heart disease risk (Cooper *et al.*, 2008). Others, for instance cupuaçu, have had little published on their health properties, but seem to have less antiradical components and more flavonoids than its relative, the cacao (Genovese and Lannes, 2009). A number of the popular fruits consumed in the Amazon are commonly referred as berries, which are

known to assist with recovery from several chronic conditions, including obesity, cancer, and cardiovascular and neurodegenerative diseases. One of them, the açai, is a classic example of a functional food containing high amounts of vitamins (thiamin, riboflavin, niacin, vitamin E, vitamin C) and minerals (iron, potassium, phosphorus, calcium) and high levels of oleic acid and dietary fiber which have been shown to possess anti-inflammatory and antioxidant attributes and also possible cardio protective and anticancer properties (Schreckinger *et al.*, 2010).

Smith *et al.* (2007) emphasizes three reasons why fruit consumption is so valuable in the Amazon region. First, fruits may be more important in providing vitamins than vegetables. Cultivating vegetable crops in tropical areas is difficult because of the hot and humid climate, which increases the spread of diseases and pests. Second, while the majority of the fruit trees are harvested during the rainy season, some produce fruit year-round and others in the dry season. Therefore, native fruits are available during the whole year. Third, urban residents in the Amazon depend, to a large extent, on the regional fruits found in markets. This is especially the case among low income populations who cannot afford the high prices of vegetables and fruits grown in other regions.

A classical book, *Frutas Comestíveis da Amazônia* (Edible Amazonian Fruits), by Paulo B. Cavalcante shows the richness of regional fruits in the Amazon, with an extensive list of 176 native and exotic fruits. Moreover, a sample of more than a hundred fruits found in Peruvian floodplains and their cultural uses are illustrated by Smith *et al.* (2007), who also cite exotic fruit trees predominantly present in home

gardens in rural and urban areas, such as mango, cajarana (*Spondias dulcis*), fruta-pão and coconut (*Cocos nucifera*).

On the other hand, there is relatively little published examining the food consumption patterns of urban settlers. The available literature about food consumption in the region encompasses mainly rural populations, especially in the eastern Amazon, concerning nutrition, subsistence strategies and limits to occupation. Some interesting findings are related to the variability of consumption depending on plant availability, marketing of forest products, dry and rainy season and environment, proximity to upland or floodplains (Murrieta, Dufour and Siqueira, 1999; Murrieta and Dufour, 2004).

Residents of urban centers in the Amazon maintain ties with the forest and the rural environment. For instance, Padoch *et al.* (2008) affirms that “the new urbanites’ maintenance of ties to rural homes and persistence of rural preferences, tastes, and housing patterns, have been in some senses a ‘ruralization’ of Amazonian cities.” The most significant case used to illustrate this “ruralization” related to food consumption is the use of the açai fruit, especially in the eastern Amazon, where it is widely consumed, not only as a staple food, in towns and cities.

Moreover, social origins play a role in the possession and diversity of garden lots. Data collected by Schmink and Cordeiro in 2004 in the state capital of Acre, Rio Branco, show that migrants from rural areas tend to have more garden lots compared to the rest of the urban population. In addition, looking at garden lots in the city of Rio Branco, Delunardo (2010) concluded that the diversity of plant species, including fruit trees (15.5% of all species identified), is higher in residencies with migrants from rural areas, and the plants are managed mainly by women as an important complement to the

family diet. In the eastern Amazon, WinklerPrins (2002) states that besides representing a link between rural and urban spaces, house-lot gardens are critical for urban survival, not only considering household subsistence and food security, but also for entering and maintaining key social networks that offer access to goods and services.

In a comprehensive article about “trees outside forests,” Long and Nair (1999) analyze various definitions of agro, community and urban forestry, including garden lots and social forestry, the later referring to naturally regenerated or planted trees on common lands or other non-private lands. There are a number of forest fragments that fit their definition in small towns of the Amazon, potentially impacting the local supply of necessities such as fruit and fuelwood. And indeed, according to them, the availability of trees, tenure regimes, usufruct, and protection problems must be addressed in any community forest programs including common areas. Long and Nair (1999) also emphasize the role of social forestry, garden-lots and agroforestry in general - which is a predominant production system in peri-urban areas of Rio Branco (Slinger, 1996) - suggesting that ecological, food supply, aesthetic and recreational benefits are very similar in urban and rural landscapes.

The ecological role of biodiversity in forests and agroecosystems has been vastly discussed and it is not the aim of this study to debate about ecological services or internal regulation of ecosystems based on number of species of organisms and their interactions. However, it is evident that fruit production or extraction in the Amazon is directly related to use of forest resources and agroforestry systems, and it is necessary to state that the diversity of fruits in these systems produce many ecological services.

For instance, Altieri (1999) identifies prevention of soil erosion, ground water replenishment, control of local microclimate, production of food, fiber, fuel, and income, as examples of potential services in natural and agricultural ecosystems.

This thesis examines the main forces behind regional fruit consumption in the state of Acre, to understand how urbanization is affecting consumption patterns in regards to access to fruits, and how individual characteristics such as income, rural or urban origin and gender shape consumption in different towns and cities. These cultural changes have implications for population health, agrobiodiversity conservation, local economy growth and cultural identity, which are key for the development of the region. Therefore, the understanding of changes in consumption patterns is instrumental to institutions interested in the improvement of current policies contributing to the overall sustainable development of the Amazon. A combination of qualitative and quantitative methods was used to understand regional fruit consumption patterns and map the major reasons behind changes brought by urbanization in the state of Acre.

Assessing the Reasons behind Consumption Patterns

Pelto *et al.* (1981) proposed an operational model to analyze factors influencing food habits, which has been widely used in nutritional anthropology studies. Their model includes three main components: the food production and distribution system, related to the availability of foods, and differing from region to region; the social-economic-political system, involving external factors such as governmental policy to control distribution systems; and finally the lifestyle factor which is the subject explored in this chapter.

Lifestyle factors of individuals include elements such as income, rural-urban residence, gender and health. The factors interact and exert various degrees of influence in food consumption habits (Kittler and Sucher, 2000). Considering these

individual characteristics, the main research question this chapter addressed was: What are the factors underlying the changes in consumption of regional fruits in urban centers? To answer this broad question this study used a combination of quantitative and qualitative approaches, described in detail in the section on combining quantitative and qualitative methods, in the previous chapter.

Data were collected systematically, with closed questions for a few factors such as income, social origin (rural or urban), age and gender, and open questions in order to understand interactions between factors influencing fruit consumption habits. The results are based heavily on interviews, although there was occasional observation of garden-lots and urban forest fragments.

Forces behind Fruit Consumption

Income was found to be a major factor influencing fruit consumption in urban environments. Comparing answers from residents in the east and west of the state, the number of people who mentioned income constraints as a factor limiting regional fruit consumption was higher in the eastern than in the western region of the state (Table 3-15). Moreover, within regions a statistical difference was also shown, with income constraint identified more frequently in larger cities than in small towns while considering limits to regional fruit consumption by interviewees (Table 3-16 and Table 3-17).

A few quotes from interviews in Rio Branco illustrate how people viewed income as a limitation to the consumption of regional fruits. For example, Antonia said: “the problem is that here, in the city, açaí and buriti are too expensive” or Genésio asserted: “Ave Maria! I would eat açaí everyday if it were cheaper.” Again referring to açaí, Raimundo, 72 years old, argued: “Our money is little, and the price is absurd. I would

like to consume more. I tried planting in my back yard but the land is low and it will not come". It was in Rio Branco that most interviewees mentioned income constraint for purchasing regional fruits affecting consumption. Indeed, the people who mentioned that income was a constraint to regional fruit consumption were consuming fewer types of fruits than the people who did not mention this problem (Table 3-18). From the previous market analysis (chapter 2) and patterns found in the exchange of fruits, the question was raised of which people are exchanging fruits. Interestingly, low income as a main hypothesis, during fruit exchange, did not seem to play a major role.

Another interesting finding was the fact that gender seems to play a role in the exchange of fruits. The majority of the population that mentioned the exchange of fruits in urban areas were women (Table 3-19 and Table 3-20). Given the decrease in consumption of regional fruits in large cities, and the fact that the exchange of fruits is a practice that seems to be increasing with urbanization, women have a significant role in exchanging regional fruits as one alternative to maintain consumption, which could be related to health benefits and/or maintaining an "economy of affection" as described by WinklerPrins and Souza (2005).

Origin, on the other hand, was expected to have an effect on the consumption of regional fruits, with people from rural backgrounds consuming more as they would have ties to the rural environment and convey consumption patterns to the cities with migration. This pattern was not shown for the data collected in this study. A number of interviewees mentioned the incorporation of regional fruits to their diets in towns, even people from cities in states outside the Amazon. For instance, Belquior, in Cruzeiro do Sul, declared: "It was love at first sight with Cruzeiro do Sul and with buriti. Every time I

go back to Fortaleza I take it to my family and, although they have never lived in Cruzeiro, they all like it very much” or Aparecida, also in Cruzeiro do Sul: “I am from a city in Paraná, but I buy buriti and açaí every day.” People also confirmed that these habits are brought from rural areas, for example, Zilma, in Mâncio Lima, affirmed: “I was raised in a *seringal* eating the fruits of the forest.” Moreover, a few interviewees affirmed that there were not many fruits available in the rural areas where they had migrated from, so the variability is important to note while considering ties to rural environments, transferring traditions and consumption patterns.

Migration from rural to urban environments was also expected to play a role in the possession of garden lots, although no statistical difference was found between people from rural and urban origins considering the possession of garden lots and its fruit species richness from the data on this study.

The Importance of Invisible Sources

The importance of invisible sources instead of purchased regional fruits can be further illustrated by the fact that Rio Branco had the highest variety of regional fruits available in open markets, however it did not translate into higher consumption compared to people interviewed in Xapuri or Porto Acre, the latter not even having an open market. For instance, 80.5% of all interviewees, including the whole state, had garden lots and consumed fruits from them. Moreover, in open ended questions, 6% (17/275) of respondents declared to use urban forest fragments as a source for fruit acquisition in a week and of this 6% only one interviewee lived in the eastern region of the state (6% - 1/17) in the smallest urban center, Porto Acre.

The number of people who mentioned the use of urban forest fragments was very small, compromising statistical testing for understanding consumption patterns.

However this use was present in places where there were still urban forest fragments available, including the second largest city in the state of Acre, Cruzeiro do Sul. In this city people mentioned the gathering of native fruits, for example, Maria Alderi said: “I rarely buy açaí because my husband gets it in the lower lands.” In forest fragments, the fruits gathered are native, usually traditional fruits, and the costs involved in it are very low. The regional fruits mentioned while interviewees explored this subject were coquinho urucuri, patauá, bacaba (*Oenocarpus mapora*), açaí and buriti, the last two being predominant over the others and representing the most traditionally consumed fruits in the urban centers visited in the west. Interviewees also mentioned how it has become more difficult over the years to reach this source. One example was stated by Mariene who lived in Rodrigues Alves: “before I used to go get buriti and açaí in the forest, but now, it seems that everywhere I go somebody has already taken them; it is difficult.” Also, it was mentioned how these fruits are now gathered not only for consumption but to sell sporadically as an alternative source of income by part of the population: “with the increase in the number of people, the açaí and buriti in the bushes are disappearing; for example, what before we could get for free, people now take to sell” (Janete, in Rodrigues Alves).

Considering garden lots, the statistical analysis does not show any correlation between variability of regional fruits consumed and the possession of garden lots (Table 3-24). Yet, the statistical analysis shows that the greater the variety of fruits present in garden lots possessed, the greater the variety of interviewee consumption, considering the variety of regional fruits consumed in a week (Table 3-25). Therefore, garden lots

are clearly playing a role in consumption of fruits as a source to increase consumption; in this case native and exotic fruits were cultivated for consumption.

However, orchard richness in urban centers of the western part of the state compared to the eastern region was not statistically different (Table 3-26). Interestingly, orchard richness did show a difference within regions. The urban centers with the richest orchards (in number of different fruit species) were found in places with intermediate degrees of urbanization, Mâncio Lima (54.3%) and Xapuri (50%). This result suggests that urbanization, at least initially, in a certain degree could be affecting orchard richness positively, perhaps as an alternative for maintaining the consumption of regional fruits in the cities (Table 3-27 and Table 3-28).

Another important source of fruits elicited in open ended interviews was the exchange of fruits with relatives and friends. From all interviews, 15% of the respondents mentioned consumption of fruits received from relatives or friends in a week, and from these 15%, 70% lived in the eastern region (50% in Rio Branco) and 30% in the west. Fruit exchange was thus predominant in the eastern region of the state (Table 3-29).

The exchange of regional fruits in Rio Branco happened between relatives and friends predominantly from rural to urban areas, although there were a few mentions of exchange also within urban areas. For instance, Regiane said: “Coquinho and ingá are very hard to find in markets; my mother brings them from her plot” referring to her mother’s residence in a nearby rural area. Also in Rio Branco, Maria mentioned she received a regional fruit from her son’s garden lot in the city: “I had cupuaçu this week that my son brought from his garden lot.”

There was no statistical difference between the consumption of regional fruits in a week by people who exchanged fruits and others, as they were consuming just as much as the other group (Table 3-30). There are indications that the exchange of fruits is practiced mostly by the population in urban centers who do not have orchards, and make use of urban forest fragments available, considering the statistical difference shown on Table 3-31 and Table 3-32)

As mentioned previously, results show that there is a difference in consumption of regional fruits between the east and the west part of the state of Acre (Table 2-3). The east, where urbanization has started earlier and there are fewer impediments to connections with other states, the consumption of regional fruits is lower and income has been a major limiting factor, especially in large urban centers such as Rio Branco. Garden lots and exchange of fruits are important alternative sources for the population in larger cities, and urban forest fragments are still being used where available, in smaller towns, although they are under pressure even in these settings. Surely not everybody living in the city has the means to have a garden lot, and that could be for a number of reasons, such as affording a fair plot size or having the skills and strength to harvest. The richness of fruit trees in garden lots seems to be higher in towns with intermediate urbanization rates, and exchange of fruits is being performed mostly by women in larger cities.

Urban Alarm: Population Health

In order to understand the forces behind consumption patterns a qualitative approach was chosen to understand individual characteristics trying to cover the most important influencing factors in changing fruit consumption patterns including health,

one of the lifestyle factors identified by Pelto et al. (1989) as a potential influence to food habits.

The issues of health, nutrition and fruit pulp quality were mentioned frequently and involved relationships with different institutions, these issues are spotlighted in Rio Branco and that seems to be the trend with urbanization. Health was a controversial topic, as each fruit has its own characteristics and personal or traditional perceptions; for example, the same fruit could be seen as beneficial or malefic in someone's diet. Moreover, the trust or distrust in the fruit processing directly affected consumption, a complex problem since it involves interactions and interests of producers, processing units, governmental institutions, vendors and finally the consumers. There is a lack in information, education and knowledge not only about the nutritional value of regional fruits of the Amazon but also their traditional use and perceptions, properties and scope in urban populations' diets.

Açaí is the example of a fruit considered to be either healthy or unhealthy by different people. For instance, Emilio mentioned: "I drink açaí because I like the taste, but also because it has vitamins" and Odiceia affirmed: "I stopped with açaí because of the cholesterol. I loved it, but it is too fatty". There seems to be a lack of information about the nutritional value and health effects of most of these fruits to the population. Maria's argument during the interview illustrates that. She stated: "I consume açaí, but I don't know if it is really good or not for my health, I take it as a meal. It is a good fruit, caloric and I like it, I adore the taste of it, but it is heavy".

Interestingly, from all 276 interviews, 10% of the respondents mentioned that health issues have changed their fruit consumption habits, and from this percentage all

of them (28), with one exception, lived in the city of Rio Branco. Therefore, there is a clear pattern of relating the consumption of regional fruits with health issues in this large city. One possible explanation for this clear difference is that urbanization also brings more information about product quality, healthy diets and treatment of diseases than in the rural areas.

Concern with the quality of processing of fruit pulp also was raised by 11 interviewees, of which 10 were in the city of Rio Branco. The major alarm was related to the transmission of Chagas disease, which was discovered to be a food borne illness in a few cases in countries where it is endemic. High-risk foods are raw meat from infected wild animals and any fresh fruit juices prepared under unsanitary food-handling practices (Pereira *et al.*, 2009). Chagas disease is an infectious and parasitic disease caused by the protozoan *Trypanosoma cruzi* and transmitted to humans by insects of the triatomine genus, known by the rural population in Brazil as "kissing bugs". It can be very severe with symptoms that may lead to death, especially in children; however in about a third of the infected patients, symptoms appear after 10 to 20 years, decreasing life expectancy by 9 years average (Instituto Evandro Chagas, 2009).

The industrialized pulps registered in the Ministry of Agriculture must meet certain health standards and handling practices in processing which should guarantee the safety of consumption. At the same time, freezing for at least 8 hours in temperatures below 20 degrees Celsius eliminates the protozoan in the juice, so there is no risk of consuming the product sold in freezing chambers because it reaches this temperature. Also, the process of pasteurization eliminates the causative agent of Chagas disease (Instituto Evandro Chagas, 2009).

Consumers were also concerned with the hygiene during the processing of pulps, since many are produced by small vendors without governmental monitoring or any quality guarantees. The facilities where fruit pulps are processed range from very artisanal, where hygiene and handling practices are not adequate, to small processing units built under the conditions determined by law (Figure 3-12 and Figure 3-13).

The quality issues were very controversial among the different agents involved in the pulp production chain. For instance, the government had a strict monitoring program not to allow fruits to be processed in open establishments without the proper sanitation. However, these were the traditional places most consumers were used to buying pulps, and since the processing was carried out in front of them, the perception of hygiene and freshness as well as the trust in the vendor was a lot higher than in the conditions when the pulps were sold in packages, and consumers could not see any of the process anymore.

The frozen pulp processed in small agro industries represented an alternative, although a number of other problems come to play included the traditional way of consuming these pulps (most people are used to consuming them fresh) and the access of small producers to an agro industry.



Figure 3-8. Buriti Palm in Mâncio Lima, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).



Figure 3-9. Vendor of buriti pulp in Rodrigues Alves, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).



Figure 3-10. Cajarana, exotic fruit, in a garden lot in Mâncio Lima, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).



Figure 3-11. Graviola, native to the Amazon, in a garden lot in Cruzeiro do Sul, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).



Figure 3-12. Small fruit pulp processing unit built by the government in Rio Branco, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).



Figure 3-13. Fruit pulp being processed by a small producer, Acre, 2010 (Photo Credit: Ana Carolina B. de Lima).

Table 3-15. Income constraint by eastern and western region of Acre, 2010

	East		West		Total	
	N	%	N	%	N	%
Mentioned income constraint	54	37.5%	17	12.9%	71	25.7%
Did not mention income constraint	90	62.5%	115	87.1%	205	74.3%
Total	144	100%	132	100%	276	100%

Table 3-16. Income constraint to fruit consumption by eastern urban centers in Acre, 2010

	Income constraint limiting consumption of regional fruits				Total	
	Mentioned		Did not mention		N	%
	N	%	N	%		
Rio Branco	45	83.3%	44	48.9%	89	61.8%
Xapuri	9	16.7%	35	38.9%	44	30.6%
Porto Acre	0	0%	11	12.2%	11	7.6%
Total	54	100%	90	100%	144	100%

Note: Chi-square=18.533; ss =.000

Table 3-17. Income constraint to fruit consumption by western urban centers in Acre, 2010

	Income constraint limiting consumption of regional fruits				Total	
	Mentioned		Did not mention		N	%
	N	%	N	%		
Cruzeiro do Sul	9	52.9%	49	42.6%	58	43.9%
Mâncio Lima	2	11.8%	47	40.9%	49	37.1%
Rodrigues Alves	6	35.3%	19	16.5%	25	18.9%
Total	17	100%	115	100%	132	100%

Note: Chi-square=6.495; ss =.039

Table 3-18. Income constraint by types of fruits consumed in a week, Acre, 2010

	Types of fruits consumed	
	Mean	N
Mentioned income constraint	1.34	71
Did not mention income constraint	1.78	194
Total	1.66	265

Note: F = 6.072; ss = .014

Table 3-19. Exchange of fruits by Income constraint in the east and west region of Acre, 2010

	Income constraint		Total
	Mentioned	Not mentioned	

Table 3-19. Continued.

			Income constraint		Total
			Mentioned	Not mentioned	
East	Exchange of fruits	Mentioned	8	17	25
			14.8%	18.9%	
	Not mentioned	46	73	119	
			85.2%	81.1%	
	Total		54	90	144
			100%	100%	100%
West	Exchange of fruits	Mentioned	2	10	12
			11.8%	8.7%	
	Not mentioned	15	105	120	
			88.2%	91.3%	
	Total		17	115	132
			100%	100%	100%

Table 3-20. Fruit exchange by sex, Acre, 2010

	Female		Male		Total	
	N	%	N	%	N	%
Mentioned fruit exchange	29	74.4%	10	25.6%	39	100%
Did not mention fruit exchange	123	51.9%	114	48.1%	237	100%
Total	152	55.1%	124	44.9%	276	100%

Note: Chi-square=6.828; ss =.009

Table 3-21. Origin by types of fruits consumed in a week, Acre, 2010

	Types of fruits consumed	
	Mean	N
Urban origin	1.76	141
Rural origin	1.56	116
Total	1.67	257

Note: F = .976; ss = .378

Table 3-22. Garden lot possession by origin of interviewee, Acre, 2010

	Rural		Urban		Total	
	N	%	N	%	N	%
Possess garden lot	92	84.4%	105	78.4%	197	81.1%
Does not possess garden lot	17	15.6%	29	21.6%	46	18.9%
Total	109	100%	134	100%	243	100%

Note: Chi-square=1.431; ss =.232

Table 3-23. Garden lot fruit species richness by origin of interviewee, Acre, 2010

Orchard richness	Rural		Urban		Total	
	N	%	N	%	N	%

Table 3-23. Continued.

Orchard richness	Rural		Urban		Total	
	N	%	N	%	N	%
0 to 3 fruit tree species in garden lot	81	74.3%	104	78.2%	185	76.4%
4 to 15 fruit tree species in garden lot	28	25.7%	29	21.8%	57	23.6%
Total	109	100%	133	100%	242	100%

Table 3-24. Number of different fruit types consumed in a week by possession of garden lots, Acre, 2010

	Types of fruits consumed	
	N (Mean)	N
Possess garden lot	1.10	29
Does not possess garden lot	1.10	89
Total	1.10	118

Note: F = .000; ss = .991

Table 3-25. Number of different fruit types consumed in a week by richness of fruit trees in garden lots, Acre, 2010

	Types of fruits consumed	
	Mean	N
0 to 3 fruit tree species in garden lot	1.54	184
4 to 15 fruit tree species in garden lot	2.17	54
Total	1.68	238

Note: F=9.422; ss=.002

Table 3-26. Orchard richness by eastern and western region of Acre, 2010

Orchard richness	East		West		Total	
	N	%	N	%	N	%
0 to 3 fruit tree species in garden lot	100	82%	91	72.2%	191	77%
4 to 15 fruit tree species in garden lot	22	18%	35	27.8%	57	23%
Total	122	100%	126	100%	248	100%

Note: Chi-square=3.325; ss =.068

Table 3-27. Orchard richness by eastern urban centers in Acre, 2010

	Orchard richness				Total	
	0 to 3 fruit tree species in garden lot		4 to 15 fruit tree species in garden lot		N	%
	N	%	N	%		
Rio Branco	67	67%	6	27.3%	73	59.8%
Xapuri	28	28%	11	50%	39	32%

Table 3-27. Continued.

	Orchard richness				Total	
	0 to 3 fruit tree species in garden lot		4 to 15 fruit tree species in garden lot		N	%
	N	%	N	%		
Porto Acre	5	5%	5	22.7%	10	8.2%
Total	100	100%	22	100%	122	100%

Note: Chi-square=14.400; ss =.001

Table 3-28. Orchard richness by western urban centers in Acre, 2010

	Orchard richness				Total	
	0 to 3 fruit tree species in garden lot		4 to 15 fruit tree species in garden lot		N	%
	N	%	N	%		
Cruzeiro do Sul	47	51.6%	9	25.7%	56	44.4%
Mâncio Lima	27	29.7%	19	54.3%	46	36.5%
Rodrigues Alves	17	18.7%	7	20%	24	19%
Total	91	100%	35	100%	126	100%

Note: Chi-square=8.044; ss =.018

Table 3-29. Fruit exchange by eastern and western region of Acre, 2010

	East		West		Total	
	N	%	N	%	N	%
Mentioned fruit exchange	27	69.2%	12	30.8%	39	100%
Did not mention fruit exchange	117	49.4%	120	50.6%	237	100%
Total	144	52.2%	132	47.8%	276	100%

Note: Chi-square=5.295; ss =.021

Table 3-30. Fruit exchange by types of regional fruits consumed in a week, Acre, 2010

	Types of fruits consumed	
	Mean	N
Mentioned fruit exchange	1.55	229
Did not mention fruit exchange	1.68	36
Total	1.57	265

Note: F =.283; ss = .595

Table 3-31. Fruit exchange by possession of orchards, Acre, 2010

	Possess orchard		Does not possess orchard		Total	
	N	%	N	%	N	%
	Mentioned fruit exchange	24	11.9%	11	23.4%	35
Did not mention fruit exchange	178	88.1%	36	76.6%	214	86%
Total	202	100%	47	100%	249	100%

Table 3-31. Continued.

	Possess orchard		Does not possess orchard		Total	
	N	%	N	%	N	%

Note: Chi-square=4.191; ss =.041

Table 3-32. Fruit exchange by use of urban forest fragments, Acre, 2010

	Use forest fragments		Does not use forest fragments		Total	
	N	%	N	%	N	%
Mentioned fruit exchange	7	29.2%	32	12.7%	39	14.1%
Did not mention fruit exchange	17	70.8%	220	87.3%	237	85.9%
Total	24	100%	252	100%	276	100%

Note: Chi-square=4.898; ss =.027

CHAPTER 4 CONCLUSIONS

The main hypothesis of this thesis was that residents of municipalities with higher degree of urbanization would be consuming a lower diversity of regional fruits. This hypothesis was confirmed in the eastern part of Acre state. At the same time, considering urban center sizes and connectivity to markets as other measures of urbanization, the same trend is seen comparing the east and west of Acre, where consumption in the west, less urbanized, was higher in diversity of regional fruits.

Urbanization has had a detrimental effect on the variety of fruits consumed by the urban population, as it comes accompanied by diet changes with increased consumption of industrialized foods, which are often not particularly nutritious. Urbanization also connects markets, facilitating the import of food commodities produced with lower costs in other regions.

One unexpected finding was that the highest diversity of regional fruits available for purchase was found in open markets of larger cities, with a flow of production from smaller towns and other states in the Amazon region. From this point of view, urbanization can be seen as an opportunity to value regional fruits in the markets. The case of organized street markets in neighborhoods of Rio Branco and the incorporation of regional fruit pulp sold in supermarkets are a few examples.

Moreover, given that the diversity of regional fruits consumed was lower in large urban centers, incentives to local production and trading of regional fruits in cities are very important. For instance, Slinger (1996) studied planned agroforestry systems in Amazon urban resettlement in the countryside, and although not assessing the impacts on the markets of Rio Branco, using models, she concluded that subsidies from the

municipal government were able to address problems of increased urbanization. A lot of the regional fruits traded in open markets and supermarkets in Rio Branco, fresh or in pulp form, come from small farmers' settlements in the peri-urban region of the city where agroforestry is a common practice.

Therefore, I suggest that initiatives that have the potential to increase consumption of regional fruits in large urban centers in Acre are, to a certain extent, related to the socio-political support of the state. It is reasonable to think that in highly urbanized areas people will have more access to information and a closer relationship to governmental institutions, and initiatives such as the organization of street markets in Rio Branco, the incorporation of regional fruit pulp by supermarkets and the higher rate of regional fruit exchange between households in large urban centers are indirectly related to the socio-political structure and state policies.

On the other hand, income appeared as a major limitation to the consumption of regional fruits in the state capital, and although fruits are available for purchase, a significant part of the population cannot afford to consume regional fruits as much as they would like. Frozen pulps are particularly expensive in supermarkets and open markets, and prices tended to increase with the degree of urbanization, perhaps because the portion of the population with high purchase power is concentrated in large cities. Policies for large cities should address issues to overcome income limitations to consumption. For instance, enrichment of urban garden lots with fruit trees could be used as a strategy, since this lifestyle factor correlated with higher diversity of fruits consumed, and a huge amount of residents already possess home gardens, but with

only a few species. Of course, lack of space plays a role in this case but it could be one possibility.

Considering urban centers of all sizes, much attention should be given to the conservation of remaining urban forest fragments and their use as common areas. At the same time, reasons for decrease in land sizes and garden lot species diversity should be addressed as they seem to be contributing to the consumption of regional fruits and potentially to household food security.

Fruit processing was a very controversial issue. At the same time that diseases associated with bad handling techniques cannot be ignored as they are extremely serious, trading fresh pulps by small producers may represent an important source of income for the poor. At the same time, fresh pulps are appreciated by most consumers as they prefer them to frozen pulps. Strategies to tackle problems with fruit processing by small producers and promotion of consumers' education about health issues are crucial but extremely complex issues. As they develop at present in the state of Acre, there will be consequences to markets and consumption of these fruits. Will consumers change their preferences in order to attain a safe product? If so, instead of purchasing fresh pulps from small producers they would rather buy frozen pulps at the supermarket, or the refrigerated pulp. Will the mass population traditionally consuming fruits everyday afford this change?

Such questions will be answered in the near future, and the ways the state government deals with changes urbanization bring, in regard to regional fruit consumption, are a challenge that will have a tremendous effect in the region. Many traditional fruits are already consumed heavily in the region and gained status among

the mass population, especially related to health benefits and cultural value, such as the case of açaí. It is crucial to make use of strategies that contribute to the visibility of all regional fruits, initially with the recognition of consumption per se and market value, and moving on to the appreciation of benefits in all their potential, considering population health, biodiversity conservation and cultural identity.

APPENDIX
REGIONAL FRUITS REGISTERED IN THIS STUDY

Common name	Scientific name	Origin
Abiu	<i>Pouteria caimito</i>	Amazon
Açaí	<i>Euterpe precatoria, Euterpe oleracea</i>	Amazon
Acerola	<i>Malpighia puniceifolia</i>	Caribbean
Araçá-boi	<i>Eugenia stipitata</i>	Amazon
Avocado	<i>Persea americana</i>	Central America
Bacaba	<i>Oenocarpus mapora, O. bacaba</i>	Amazon
Bacuri	<i>Platonia insignis</i>	Amazon
Banana	<i>Musa</i>	Tropical Asia
Biribá	<i>Rollinia mucosa</i>	Amazon
Buriti	<i>Mauritia flexuosa</i>	Amazon
Cacau	<i>Theobroma cacao</i>	Amazon
Cajá	<i>Spondias mombin</i>	Tropical America
Cajarana	<i>Spondias dulcis</i>	Polynesia
Carambola	<i>Averrhoa carambola</i>	Tropical Asia
Cashew	<i>Anacardium occidentale</i>	Brazil
Citrus	<i>Citrus ssp.</i>	Central to southeast Asia
Coconut	<i>Cocos nucifera</i>	Pacific and Indian ocean
Cupuaçu	<i>Theobroma grandiflorum</i>	Eastern Amazon
Fruta-pão	<i>Artocarpus altilis</i>	Polynesia
Goiaba	<i>Psidium guajava</i>	Tropical America
Graviola	<i>Annona muricata</i>	Amazon
Ingá	<i>Inga spp.</i>	Tropical America
Jaca	<i>Artocarpus heterophyllus</i>	India
Jambo	<i>Syzygium malaccense</i>	Malaysia
Jenipapo	<i>Genipa americana</i>	Amazon
Mango	<i>Mangifera indica</i>	Tropical Asia
Maracujá da mata	<i>Passiflora nitida</i>	Amazon
Urucuri	<i>Attalea phalerata</i>	Amazon

Papaya	<i>Cacarica papaya</i>	Tropical America
Passion fruit	<i>Passiflora edulis</i>	Southern Brazil
Patauá	<i>Oenocarpus bataua</i>	Amazon
Pineapple	<i>Ananas comosus</i>	Amazon
Pupunha	<i>Bactris gasipaes</i>	Amazon
Tucumã	<i>Astrocaryum aculeatum</i>	Amazon
Watermelon	<i>Citrullus vulgaris</i>	African

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BIOGRAPHICAL SKETCH

Ana Carolina Barbosa de Lima was born in the city of São Paulo in the southeast of Brazil to Vera Lucia Barbosa de Lima and Getúlio Gomes de Lima. Growing up she lived in São Paulo and completed her last year of high school in Sydney, Australia. She then attended the University of São Paulo where she graduated with a bachelor's degree in agriculture engineering. While enrolled at the University of São Paulo she attended Concordia University in Montreal, Canada, studying for a year as part of an agreement between both universities. During her undergraduate studies she became interested in rural development and extension.

Shortly after graduating she worked for a small agricultural company focusing on socio-environmental certification for small farmers and forest communities in Brazil. Through her work with this company she built relationships with extractive communities in Acre and became fascinated with their culture. She then decided to pursue her Master of Arts in Latin American Studies with a thematic concentration in tropical conservation development and was granted a graduate assistantship from the Center for Latin American Studies and a Compton fellowship to conduct field work in Acre. She is currently applying for a Ph.D. in anthropology and hopes to pursue a career in academia.