Changing Lives, Changing Fields:

Diversity in Agriculture and Economic Strategies in two Caboclo Communities in the Amazon Estuary

by

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Abstract

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Angela Steward

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Rural residents of the Amazon estuary (*caboclos*) have long integrated diverse, small-scale agriculture into a complex livelihood system. In response to government restructuring, market shifts, and regional urbanization patterns, caboclos in the Amazon estuary have significantly modified their economic strategies over the past 15 years. This dissertation examines economic change in the caboclo communities of Carvão and Mutuacá, Brazil. In the study area, residents describe a process of change whereby "nature"— agricultural areas, forests, and waterways—has lost its central importance to survival. In Carvão, livelihood change is characterized by community-wide shifts away from agriculture, as residents replace farm income with non-farm, urban income in the form of government wages, pensions, and welfare benefits. In Mutuacá, residents also incorporate non-farm income into a rural-based livelihood system, but are increasing the production of the açaí palm (*Euterpe oleracea* Mart.) in agricultural areas. Through an interdisciplinary research approach that draws on methods from ethnobotany, ecology, and anthropology, this dissertation has two main objectives. The first is to examine the state of agriculture in Carvão and Mutuacá—communities where agricultural production

is being downsized and simplified. This study highlights both variation in farming strategies and patterns of agrobiodiversity in fields and home gardens. The second goal is to outline a new model of economic production in Carvão and Mutuacá based on a concept of hybridity, where urban income is combined with "age-old" rural activities. Results from property visits, interviews, and botanical surveys indicate that contrary to research on global agricultural change, which documents the erosion of agrobiodiversity with the reduction of farm area and with market integration, farmers in Carvão and Mutuacá cultivate high levels of agrobiodiversity in fields and home gardens. Research also indicates that livelihoods have become more urban in nature and thereby contradict previous ethnographic representations of caboclo economic life. This dissertation argues, however, that recent changes be viewed as a historical continuity. Residents' quick incorporation of urban income into a rural livelihood system demonstrate villagers' sense of opportunism and flexibility—traits that have long been central to caboclo economic strategies—and have ensured continual access to natural and social resources in a dynamic landscape.

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To the People of Carvão and the Foz de Mazagão,

for showing me another way of living

Table of Contents

List of Tables

List of Figures

CHAPTER ONE: Introduction and Study Design

Introduction

In recent years, scientists studying rural, agrarian societies across the globe have documented two major processes of change. One finding is that smallholders are abandoning agriculture for wage labor and non-farm informal service sector activities. Scientists have also called attention to the erosion of agrobiodiversity traditionally maintained by smallholders worldwide. [1] While many researchers assume shifts away from agrarian livelihoods result in the erosion of agrobiodiversity, few studies actually examine patterns of cultivated plant diversity in rural communities undergoing economic change. As smallholders abandon agrarian livelihoods across the globe, it is crucial that we understand how agrobiodiversity is affected by these changes. To address this need, this dissertation examines economic change and patterns of cultivated plant diversity in two caboclo[2] communities in the Amazon estuary—where residents have modified livelihood strategies in response to government restructuring, changes in markets for agricultural products and regional urbanization patterns.

[1] Agrobiodiversity, also cultivated plant diversity, in its most simple definition refers to variation in crop species, semi-domesticates and wild species in agricultural systems that are either cultivated or conserved by farmers (Brookfield 2001). Some scientists, however, use a broader definition of the term to include all biological components in the farming system. Wood and Linné (1999: 1-2), for instance, define agrobiodiversity as: "all crops and livestock and their wild relatives, and all interacting species of pollinators, symbionts, pests, parasites, predators, and competitors."

[2] Caboclos are rural peoples of mixed Amerindian, European and African descent in Amazonia. The caboclo peasantry evolved in the aftermath of Portuguese colonialism in the late 1700s (Parker 1985).

Literature Review

Livelihood diversification and de-agrarianization

Across the globe smallholder farming communities are in transition. Researchers studying agrarian societies observe a process of de-agranization, or livelihood diversification, whereby developing country peasants are abandoning agriculture and rural activities to engage in non-farm public sector and informal service activities (Bryceson et al. 2000). One recent review from Latin America, for instance, reported that non-farm incomes account for 40% of total rural incomes in Latin American and the Caribbean, up from 25% in 1986 (Reardon and Escobar 2001). In sub-Saharan Africa, where this process is even more advanced, rural non-farm income was found to account for 60–80% of household income in the late 1990s, in contrast to approximately 40% in the 1980s (Bryceson 1999).

De-agrarianization trends are attributed to new obstacles that have arisen from globalization processes, which have made it difficult for smallholders to survive through agriculture alone. In particular, structural adjustment programs (SAPs) following debt crises in the late 1980s have called for economic trade liberalization or the opening up of international markets across the globe. As a result, agricultural markets and small farmers have become vertically integrated into a global system. Today, many small farmers in the global south are forced to compete with subsidized producers from northern countries. Structural adjustment has also called for decentralization and decreased government spending; and thus in many countries, market changes coincide with the loss of agricultural subsidies and rural extension programs targeting small farmers (Bryceson 1996, Ellis 1998). Furthermore, in some areas of the world such as in Latin America,

these changes have occurred against a backdrop of declining land reserves for farmers—and thus small farmers are unable to produce on a larger scale to compensate for declining prices of agricultural crops (Janson 2000).

Researchers argue that these obstacles have spurred small farmers into diverse non-farm jobs worldwide, whereby specific employment opportunities depend on the local socio-economic context. In some areas, globalization and structural adjustment have benefited the rural poor by bringing industrial development and wage labor to the countryside (Janson 2000, Rigg and Nattapolwat 2001). In rural areas where economic development initiatives have failed or are non-existent, residents increasingly travel to and from regional cities to engage in urban wage labor activities (Bryceson 1996, Ellis 1998). For rural folks who commute, the recent growth of small and medium sized towns, as opposed to historically large urban centers, has been most important in providing rural residents with new employment opportunities (Graziano da Silva and Del Grossi 2001, Reardon and Escobar 2001). In the Northeast of Brazil, for instance, researchers have found that county governments are the largest rural employers (Graziano da Silva and DelGrossi 2001).

Smallholder agricultural systems and global agrobiodiversity

In a separate but related literature, anthropologists and ethnobotanists have documented changes in farming techniques and patterns of agrobiodiversity in smallholder communities across the globe. While the de-agrarianization literature documents broad changes in rural economic strategies in peasant societies, the latter studies describe change in farmers' agricultural operations and resulting patterns of biodiversity, as

smallholders are affected by globalization processes. Researchers studying these patterns have increasingly called attention to the erosion of global agrobiodiversity, also called cultivated plant diversity. Researchers estimate that about 75% of the genetic diversity of cultivated plants has been lost across the globe since the beginning of the century (Shand 1997). This statistic is alarming for many reasons; smallholder agrobiodiversity not only provides human society with essential resources, such as food, fibers, fuels and medicines, but it is also the genetic material upon which modern crops were developed. Throughout history, farmers and modern crop scientists have relied upon crop genetic resources conserved in smallholder agroecosystems to develop drought and disease resistant crops to overcome crisis situations. Many scientists argue that in light of global climate change and continued human population growth, conserving crop genetic diversity is crucial to maintaining global food security and sustaining the future of humanity (Brush 2004).

Global erosion of agrobiodiversity is attributed to various factors. Many scientists link the loss of genetic diversity to agricultural modernization and the subsequent spread of Green Revolution technologies, [3] which promoted uniformity as opposed to diversity in agricultural systems (Brush 1995; 2004, Thrupp 2000). Researchers also describe agrobiodiversity losses as a consequence of economic trade liberalization and regional urbanization patterns. In particular, researchers have documented the erosion of agrobiodiversity as smallholders direct their attention toward market-oriented production,

[3] The Green Revolution refers to the post-war period of agricultural modernization that led to a significant increase in global food production. During this time, scientists developed high-yielding hybrid varieties of staples crops, such as corn and rice, which were later distributed to developing-world farmers. In many regions, these hybrid varieties replaced local varieties and thus reduced regional crop genetic diversity. A wide literature describing the history and global consequences of this period exists. The reader is referred to Brush (2004) for an overview of the Green Revolution and its environmental and social consequences.

to the exclusion of subsistence cultivation in diverse land use types[1] (Humphries 1993, Henrich 1997, Peroni and Hanazak 2002). Finally, while few studies examine patterns of cultivated biodiversity in smallholder communities undergoing de-agrarianization, livelihood diversification and rural exodus are often cited as among the greatest threats to global agrobiodiversity by experts in this field (see Brookfield et al. 2002, Brush 2004). Researchers predict that agrobiodiversity losses occur when broad livelihood shifts away from agriculture result in the simultaneous reduction in total farm area (Cleveland et al. 1994, Brookfield et al. 2002).

As de-agrarianization becomes rampant across the globe, it is imperative that we understand how agrobiodiversity fares in communities undergoing economic change. This dissertation addresses this need and examines the process of de-agrarianization as well as patterns of agrobiodiversity in two peasant communities in the Brazilian Amazon, a region where studies on agrarian change are rarely conducted (Harris 2000a). Research for this dissertation was undertaken in the municipality of Mazagão, state of Amapá, Brazil, in two Amazonian peasant (*caboclo*) communities. Based on local oral histories and the regional ethnographic literature, we know that until recently residents in the study area, and caboclos across Amazonia, maintained a diverse, complex rural livelihood system. While previous ethnobotanical research has not been conducted in the study communities, scientists have recorded high levels of agrobiodiversity at both the field, farm and community levels in caboclo communities in Mazagão (Pinedo-Vasquez et al. 2002), and in similar peasant communities across the Brazilian and Peruvian Amazon (Denevan 1984, Hiroaka 1992, Padoch and Wil de Jong 1993).

Research Objectives

Building on recent literature on change in smallholder communities across the globe, this dissertation has two main goals. The first is to describe the current state of livelihoods and economic strategies in communities of Carvão and Mutuacá, Brazil. In doing so, I outline the process of economic change by comparing current livelihood patterns to historical patterns. Building on the existing anthropological and ethnobotanical literature, which characterizes caboclo livelihoods as rural in nature, I compare economic patterns in the study site to patterns described by other anthropologists and ethnobotanists working in caboclo communities across Amazonia.

The second main objective of this dissertation is to examine agricultural practices and patterns of agrobiodiversity maintained by farmers in the study area. In particular, I examine whether or not smallholder agrobiodiversity is high compared to levels ethnobotanists have previously recorded in peasant communities across Amazonia. Because agrobiodiversity is related to farmers' management strategies, I also describe agricultural practices and technologies. In both localities, I document the agricultural systems in which agrobiodiversity is maintained and which management practices influence patterns of cultivated plant diversity. I also seek to identify the socio-economic parameters that influence patterns of agrobiodiversity, such as income level, landholding size, and family history. In order to understand if differences in ecology have affected these larger economic and social changes, research was conducted across different

environmental zones—in one upland (*terra firme*) village and one floodplain (*várzea*) community.[4]

Summary of Dissertation Results and Arguments

Research results indicate that residents in both communities maintain complex livelihoods—where non-farm, urban income is combined with rural activities, such as farming, fishing, hunting and the collection of forest products. While livelihoods in both community exhibit this hybrid form, non-farm, urban cash income plays a different role in each community. In Carvão (the upland community), families have, with few exceptions, *replaced* farm income with non-farm income in the form of government wages, informal service sector wages, pensions and welfare benefits. In Mutuacá (the floodplain community), residents earn non-farm income *in addition* to agricultural income. In Carvão, falling prices for upland crops, namely manioc (*Manihot esculenta*), have prompted farmers to abandon commercial production, such that total farm area is in decline. In Mutuacá, on the other hand, farmers are increasing the production and sale of the açaí palm (*Euterpe oleracea*), native to the várzea, in response to the growing local demand for the fruit. Thus, even though livelihoods are diversifying in Mutuacá the total area under agricultural production is increasing. At the same time, however, research results from Mutuacá indicate that because farmers are preoccupied with planting açaí, they are no longer cultivating subsistence crops in *roçados,* a land-use common in Amazonia and characterized by high levels of agrobiodiversity (Pinedo-Vasquez et al. 2002).

[4] The landscape of the Amazon estuary is traditionally divided into two main environmental areas: the tidal floodplains influenced by daily tides and the uplands, which are higher in relief and escape daily and seasonal flooding.

Based on the findings of scientists studying global agrarian change, we would expect that agrobiodiversity maintained by farmers in the study area—in a community where total farm area is in decline and in one where farmers are specializing to meet new market demands—to be lower than the agrobiodiversity maintained in traditional Amazonian peasant communities not yet affected by macro-level socio-economic processes. Research results, however, indicate that Carvão and Mutuacá farmers cultivate a great diversity of plants in the landscape. In fact, levels of agrobiodiversity maintained in home gardens in the study area are higher than previously recorded in caboclo communities in the same municipality (c.f. Pinedo-Vasquez et al. 2002). Diversity is partially explained by the retention of traditional agricultural practices, such as seed exchange through kin networks. However, farmers also cite diverse cultural and social motivations for conserving plant diversity in fields and home gardens. These findings illustrate that the drivers of smallholder agrobiodiversity loss and resilience are more complex than previously imagined. Insights into farmers' motivations for conserving agrobiodiversity will help inform policies aimed at managing the effects of globalization processes on rural livelihoods, smallholder land use and patterns of biodiversity.

Moreover, observations of economic change in the study area have implications for how we understand caboclo economic strategies in Amazonia. Until the present, anthropologists have described caboclo livelihoods as rural in nature and made up of a diverse array of commercial and subsistence activities, including small-scale agriculture, hunting, fishing and the management and extraction of forest products (Wagley 1954, Ross 1978, Nugent 1993, Harris 2000b). Anthropologists have also described caboclos' astute environmental knowledge systems, which they argue have allowed them to survive

since the peasantry came into being in the late 1700s (Harris 2000b). Research from this dissertation shows that caboclos in the study area maintain hybrid livelihoods, where non-farm, urban income is integrated with age-old rural activities. To obtain cash income, caboclos have had to acquire new forms of urban knowledge—of government institutions, bureaucratic procedures and urban geography. Despite these changes, this dissertation argues that recent economic changes can be viewed as a historical continuity. Residents' quick incorporation of government income into a rural livelihood demonstrates villagers' sense of opportunism, recoverability and flexibility—traits that have long been central to caboclos' economic strategies, and have ensured continual access to natural and social resources in a dynamic landscape. Finally, the dissertation makes an important contribution to the literature on caboclos, the mixed Amazonian peasantry because it focuses on two caboclo communities where residents also self-identify as Afro-Brazilians, the descendants of inhabitants of a former *quilombo* (an escaped slave community) settled in the late 1800s.

Study Site

Geographic location

Research for this dissertation was conducted in the communities of Carvão and Mutuacá located in the state of Amapá, Brazil in the Amazon estuary (Figure 1.1). Amapá lies in the extreme north of Brazil and shares its northwest border with French Guiana and Suriname (4º15'50"N, 1º13'54" S; and 49º52'54"E to 54º52'30"W). To the southwest of Amapá is the Brazilian state of Pará, to northeast the Atlantic Ocean, and to the southeast are the estuarine islands of the Amazon River. Carvão and Mutuacá are located in the

municipality of Mazagão,[5] which was the second municipality founded in Amapá by the Portuguese during the colonial years in the late 1700s. The communities are located just 50 kilometers from the capital city of Macapá and the port city of Santana. Residents are connected to the nearby cities of Macapá and Mazagão Novo, the administrative center of the municipality (at a distance of 15 kilometers) by the state highway-AP 10 and to Santana by the Amazon River and its tributaries. Both communities are part of the district (*distrito*) of Carvão, which is made of three communities, the adjacent upland communities of Carvão and Caimaipi and the tidal floodplain settlement that stretches along the Mutuacá River. The Mutuacá River is one of five rivers that correspond to a small drainage basin referred to as the Foz de Mazagão (Figure 1.2).

[5] The territory of Brazil is broken up into states, municipalities, districts and communities. Municipalities are county-like divisions that have a central seat called a *sede*. Aside from the "county seats," municipalities generally consist of a few districts, smaller cities, *distritos* and rural villages or communities (*comunidades*).

Figure 1.1. Map showing the Study Area and proximity to important regional cities in Amapá, Brazil.

Figure 1.2. Map showing the study communities, Carvão and Mutuacá, and the five rivers of the Foz de Mazagão, state of Amapá, Brazil.

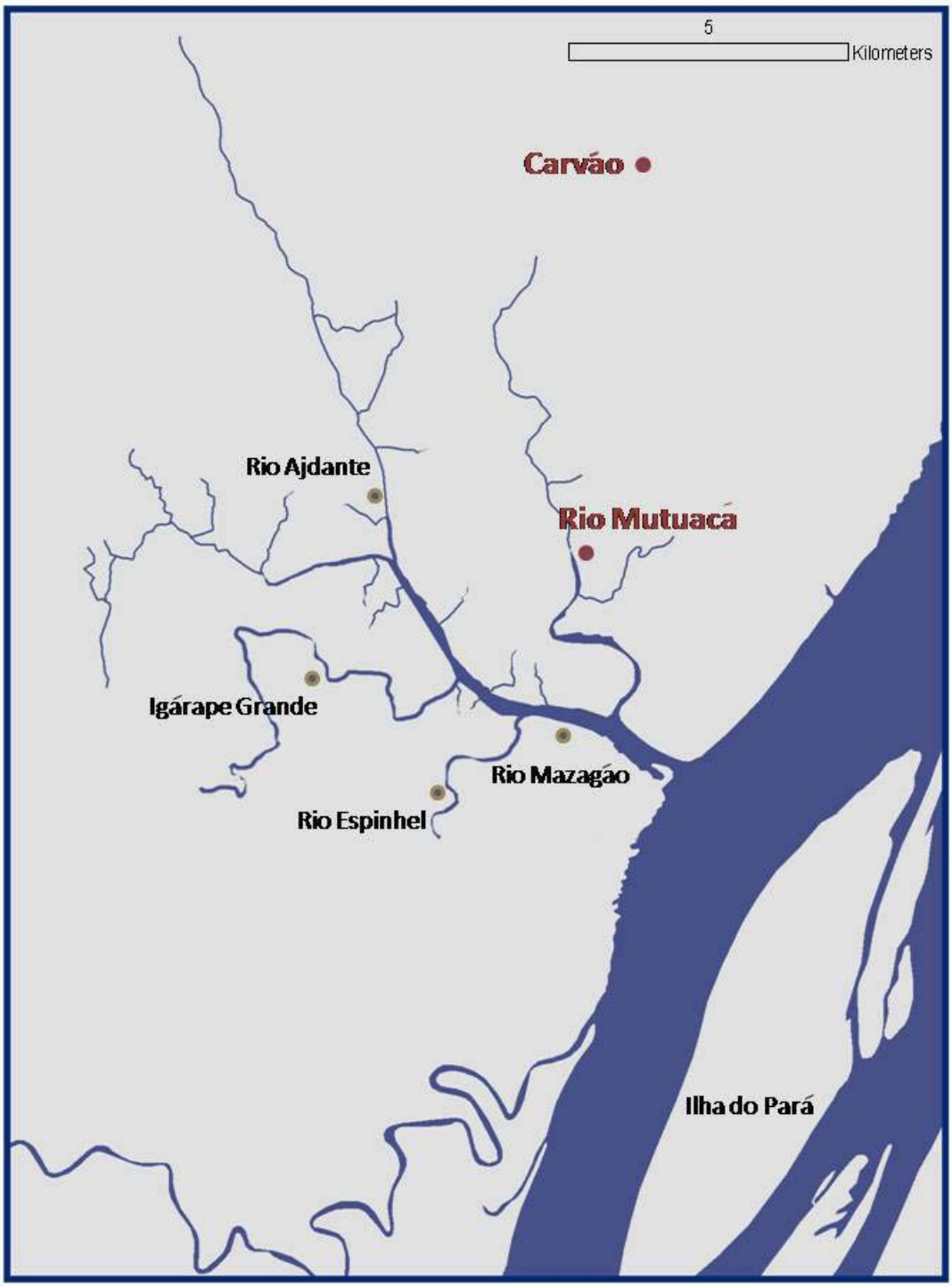
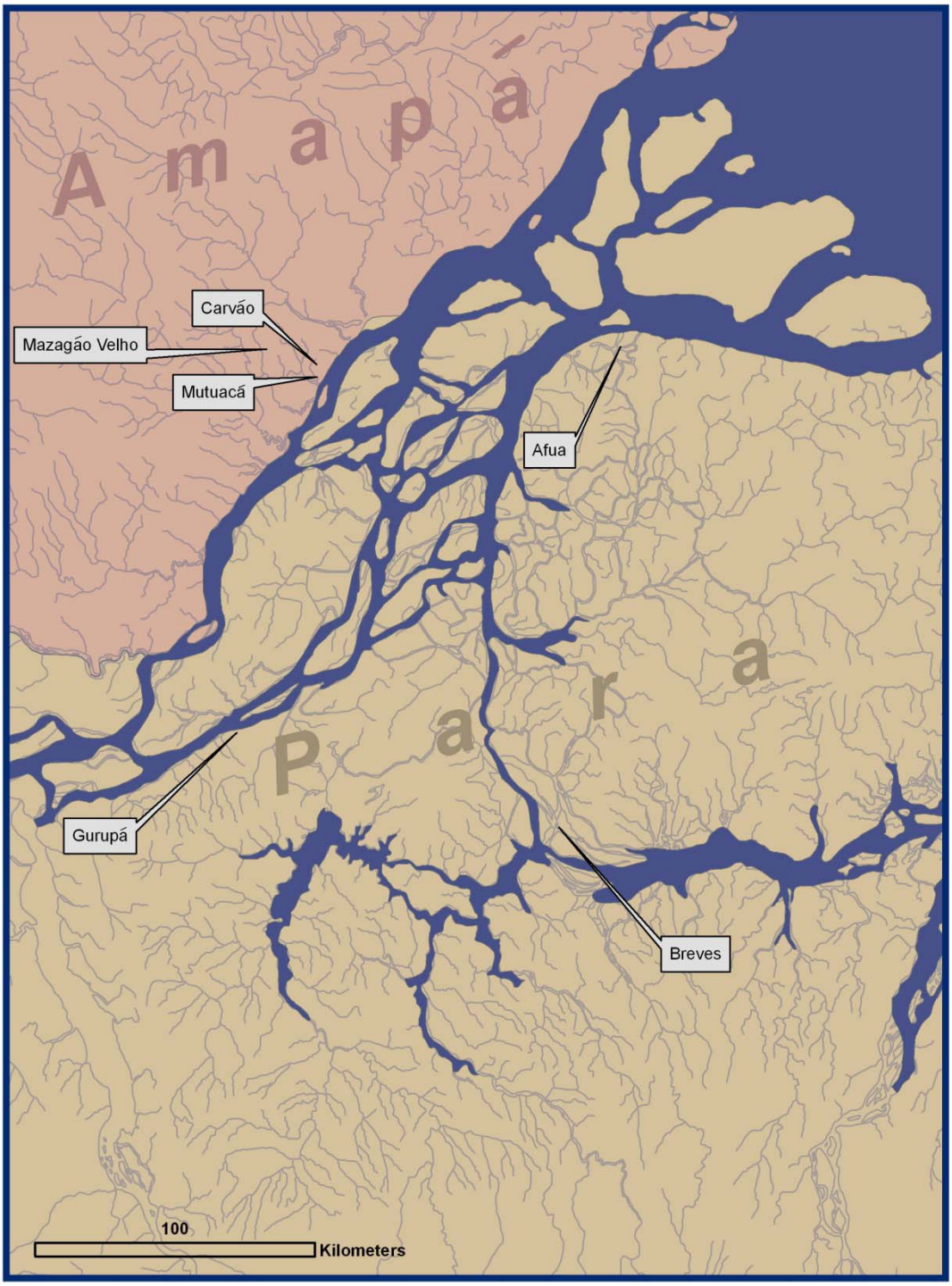


Figure 1.3. Map showing study communities, Carvão and Mutuacá, and cities from which Carvão and Mutuacá residents have migrated in the states of Amapá and Pará, Brazil.



Climate and ecology

Located in the estuary of the Amazon, the greater Mazagão region is characterized by an equatorial humid climate with two seasons: a rainy season (winter) from December through June, and a dry season (summer) from July through December. The landscape of the study area can be divided into two main environmental areas—the terra firme (the uplands) and the tidal floodplains (the várzea). The terra firme is higher in elevation and escapes daily flooding while the tidal várzea is influenced by daily tides, where water levels rise and fall between one and four meters.

Carvão is located in the terra firme adjacent to the Mutuacá River. The community of Mutuacá is a várzea settlement scattered over both sides of the river. The terra firme areas surrounding Carvão encompass mature upland forests, secondary forests, savannas, flooded savannas and upland lakes. The tidal várzea is covered with mature floodplain forests, savannas, and oligarchic forests with a high density of palms, such as *Mauritia flexuosa* and *Euterpe oleracea* (Peters et al. 1989). In recent years, both communities have grown in population and spatial extent. Community expansion is more pronounced in Carvão; new construction in Mutuacá is restricted to the areas of high land along the banks of the river and small streams.

Settlement and cultural history

The settlement of the communities of Carvão and Mutuacá dates back to the late 1890s. According to oral histories, the first[6] inhabitants of the area settled near the entrance of the present-day community of Carvão. As the story relates, Carvão was founded by a young couple from the nearby colony of Mazagão Velho[7] who came to the area to cultivate manioc roots (*Manihot esculenta*). The first inhabitants were followed by additional family members from Mazagão Velho. This small group of extended kin later resided in the terra firme of Carvão adjacent to the várzea floodplains of Mutuacá—a geography that gave them access to a diversity of natural resources across both environmental zones.

The population of the region has fluctuated since these early days with regional economic boom and bust cycles for various plant products. Until the 1960s, residents engaged in the commercial extraction of non-timber forest products, including Amazonian wild rubber, *Hevea brasiliensis*, oil-producing seeds of *andiroba* (*Carapa guianensis*), *murumurú* (*Astroçaryum murumuru*), and *pracaxi* (*Parkia* sp.). Later residents combined farming with the extraction of timber *cedro* (*Cedrela odorata*), *sumaúma* (*Ceiba pentandra*), *ucúuba* (*Virola surinamensis*), *muiratinga* (*Maquira coriacea*), *andiroba* (*Carapa guianensis*), and *mogno*; *Swietenia macrophylla* (Pinedo-Vasquez et al. 2001)—for international export markets. When timber stocks were depleted by the 1970s, residents again modified economic activities. Residents in

[6] In this section, I refer to the postcolonial settlement of the region. When Europeans first arrived in the estuary (in the vicinity of Macapá) in the 1500s, the region was inhabited by indigenous peoples of the Tupi-Guarani lineage (Parker 1985).

[7] Mazagão Velho was a planned colony settled in 1772 by the Portuguese colonial administration as part of a larger effort to secure the area from other European nations. By the end of 1775, a total of 139 families and their slaves were living in the settlement.

Mutuacá engaged in small-scale commercial timber production geared toward local markets, the extraction of freshwater shrimp, subsistence farming, hunting and fishing; since the late 1980s, the sale of açaí fruits has gained importance in Mutuacá. Since the 1970s through the present, Carvão farmers have engaged in the commercial production of manioc roots for the fabrication of coarse manioc flour (*farinha*), along with fishing and hunting in the nearby forests, savannas, and rivers.

While the founders of the original Carvão-Mutuacá settlement were of African descent, processes of rural migration linked to economic cycles brought together diverse peoples from varying ethnic background. Today, many residents in the study area report to have migrated from nearby várzea communities—including the Ilha do Para, Gurupá and Afuá (Figure 1.3). Others come from as far as the Northeast of Brazil. Because of this history of cultural mixing, the people of Carvão and Mutuacá are considered caboclos—poor rural Amazonians of mixed Amerindian, European, and African descent (Lima 1992, Harris 2000b, McGrath 2000). The caboclo peasantry in Amazonia came into being in the aftermath of Portuguese colonization, an era characterized by disease and violence. The Amerindians, Europeans, and African slaves who survived this period formed a diverse peasantry. To endure, residents relied on diverse natural resources and cultural knowledge derived from various cultures (Parker 1985). Today, the caboclos are the most populous ethnic group in rural Amazonia. Caboclos who live in the várzea floodplains are also referred to as *ribierinhos* (riverbank dwellers). This term is used interchangeably within the ethnobotanical and anthropological literature of Amazonia to describe rural peoples of the region.

Research Methods

Research for this dissertation followed an interdisciplinary approach, drawing on methods from economic botany, ecology, and anthropology. The various types of data included in this study were gathered using the following methods: interviews, farm visits, participant observation, and vegetation sampling. Data on demographic patterns in the community and residents' current economic activities were gathered through structured questionnaires (household economic surveys) applied in both communities. A total of 80 household economic surveys were conducted in Carvão; interviewees were chosen at random from a total of 140 households. In Mutuacá, I conducted 17 household economic surveys with heads of household chosen at random from 25 households. Information on agricultural activities and farmers' management strategies was gathered through farm visits and on-site interviews. Seventeen site visits were conducted in Mutuacá with available farmers. Farming families were first identified during household economic surveys. During the course of fieldwork, I relied on key informants to verify descriptions of farmers' management strategies.[8]

In each community, I accompanied farmers to the fields to observe all agricultural operations. Plant inventories were conducted in agricultural fields and home gardens in the study area following the recommendations of Brookfield et al. (2002). A detailed description of plant sampling methods is included in Chapter Three, which reports on these findings. Finally, historical information—on how residents managed plant resources in the past, on the history of settlement in the study area, and on general

[8] Names of informants cited in this dissertation have been changed to respect individuals' privacy. In Chapter Five, I provide real names of actors who appear in the community/shared history and are thus public figures; in this chapter, however, I hide all informants' identities when citing their views and opinions.

information economic and social patterns—was gathered through oral history interviews with ten residents in the study area. These informants were community elders reputed to know community history well. Oral history interviews were conducted following the 2005 standards of the American Oral History Association. I referred to Bernard (2000) and Alexiades (1996) to design household economic surveys and semi-structured interviews on farming practices.

To supplement the empirical research, data were also collected from various governmental institutions in Amapá. Information on the early history of Amapá and Mazagão was gathered from the public archives of the state of Pará, which also houses all information for the state of Amapá. The *prefeitura* of Mazagão, the mayor's office, and the *Instituto Brasileiro de Geografia e Estatística* (IBGE) provided demographic data for the Mazagão region. The *Instituto de Desenvolvimento Rural do Amapá* (RURAP) Amapá's agrarian extension and development agency supplied quantitative data on agricultural production in Carvão and information on agricultural extension services provided through their agency to farmers in the study area. Additional information on economic history and rural development in Mazagão and Amapá was gathered through interviews with government employees at the Secretary of Agriculture (S*ecretaria de agricultura do Amapá*) of Amapá, the *Empresa Brasileira de Pesquisa Agropecuária* (Brazil's agency for agricultural research-Macapá), and the *Instituto Nacional de Colonização e Reforma Agrária* (INCRA) (Brazil's land reform and regulation agency)—all of which are located in the city of Macapá, Amapá.

Structure of Dissertation

Following this introduction, this dissertation unfolds in eight chapters. Chapter Two provides background information on the ecology of Amapá and the immediate environment of the study site. The intention of this review is to describe the natural resource base from which residents make their living. The second half of Chapter Two contains a literature review on peasant agricultural practices and patterns of agrobiodiversity in Amazonia. Chapter Two also describes the importance of cultivated plant diversity to farmers and their role in maintaining ecosystem services in the landscape. This review provides a reference to which patterns of agrobiodiversity described in Chapter Three are compared. Chapter Three presents the results of agricultural surveys in Carvão and Mutuacá and is also divided into two main sections. The first describes variation in farming strategies and the second describes patterns of cultivated plant diversity in the communities. Chapter Four contains a review of the ethnographic literature on caboclos in the Brazilian Amazon—describing the evolution of the mixed peasantry following Portuguese colonization and changes in caboclo economic strategies as observed by anthropologists and ethnobotanists since the early 1950s. Chapter Five describes the history of the study site, outlining settlement patterns and changes in plant management strategies and economic strategies. Chapters Six and Seven present the results of household economic surveys in Carvão and Mutuacá respectively. Both chapters describe new social and economic patterns in the study area. Chapter Seven concludes by presenting a new model for caboclo livelihoods based on these results. Chapter Eight summarizes main research findings and arguments and discusses

the implications of research results for conservation and development in Amapá and for Amazonia.

CHAPTER TWO: Ecology of Amapá, Brazil and Agricultural Systems in Amazonia

Introduction

This chapter provides background information on the ecology of the state of Amapá, Brazil and the municipality of Mazagão and summarizes the ethnobotanical literature on ribereño and caboclo agricultural systems in Amazonia, [9] describing some of the ways in which traditional peoples have used the plant resources in the landscape. The chapter is divided into two sections. The first describes the climate of the region and its diverse ecosystems—specifying differences in geomorphology, soils, and vegetation patterns. The discussion can be placed within the larger literature on the ecology of eastern Amazonia and the estuarine region (Moran 1993, Padoch and Pinedo-Vasquez 1999). For a more detailed discussion of the environment and ecosystems of Amazonia, the reader is referred to the works of Sternberg (1975), Sioli (1984), Moran (1993) and Junk (1997). The second section contains an overview of the diverse nature of caboclo and ribereño agricultural practices; it also describes how the system of swidden-fallow cultivation results in a heterogeneous landscape of diverse vegetation types and embedded habitats. I also discuss the value of cultivated plant diversity to farmers and how it is maintained in the landscape through farmer selection.

Climate

Located in the estuary of the Amazon, the greater Mazagão region is characterized by an equatorial humid climate with two seasons: a rainy season (winter) from December through June, and a dry season (summer) from July through December. The temperature

[9] In Brazil, caboclos are rural Amazonians of mixed Amerindian, European and African descent; ribereños are their counterparts in the Peruvian Amazon.

in the Mazagão region remains fairly constant at an average of 25 degrees Celsius, varying from a high of 33 degrees Celsius to a low of 22 degrees Celsius (Rodriques dos Santos 2005). Typical of many tropical regions, the relative humidity remains high year round, ranging from 81% during the dry season to 93% during the wet season (Teixeira 1954). Despite its relatively constant temperature, Amapá is characterized by a high degree of seasonality, marked by extreme differences in rainfall. Amapá and Mazagão experience an extreme dry period when rainfall can fall to a low of 10.2 mm/month and a wet season when rainfall amounts to a high of 280 mm/month (Padoch and Pinedo-Vasquez 1999). Climatic research stations in Mazagão verify that 80% of rainfall falls within the first six months of the year (IEPA 2005); however, the dry months are not entirely without rain. Periodic rainfalls during the dry season account for the absence of droughts that periodically occur in the northeastern states of Brazil (IEPA 2005). The high degree of seasonality is characteristic of the Amazonian estuarine region and differs from western Amazonia where rain falls daily throughout the year (Meggers 1974).

Ecosystems in the Landscape of Mazagão, Brazil

The Amazon[10] has traditionally been divided into two main environmental regions, the uplands and the lowlands or the terra firme and várzea respectively (Meggers 1974, Hiraoka 1992, Moran 1993) based on differences in elevation, degree of inundation and soil characteristics. The upland zones which escape annual flooding are characterized by aged and nutrient poor soils derived from Precambrian geologic formations (Meggers 1974). The lowland floodplains are subject to daily or seasonally flooding, and in contrast to terra firme soils are characterized by young alluvial soils with a high organic content that make them more fertile and suitable for agricultural production. As many authors have argued, the traditional focus on this duality has obscured the great diversity of the region. Within the terra firme and várzea various ecosystems and habitats are found (Hiroaka 1992, Moran 1993). For instance, in Mazagão there are three ecosystems associated with the uplands and lowlands respectively, including: upland forests, upland savannas, upland lakes, flooded savannas, várzea forests, and várzea savannas (Table 2.1).

[10] Defining the geographic limits of Amazonia is a complicated task. Amazonia is technically the area of the Amazon Valley or the drainage basin of the Amazon River and all its tributaries, an area covering six million km^2 with four million km^2 belonging to Brazil. In Brazil, the legal Amazon occupies about five million km^2 and includes areas of the Brazilian plateau, which falls outside of the drainage base. This geopolitical definition is used in determining land/tax values and exemptions in Brazil, and thus takes an expansive view (Moran 1993).

Table 2.1. Ecosystems of the municipality of Mazagão, Amapá, Brazil.

I. Terra Firme with *areas alagadiças*	**II. Várzea**
A. Terra firme forests (*floresta de terra firme*)	A. Várzea forests (*floresta de várzea*)
B. Terra firme savannas (*campos de terra firme*)	B. Várzea savannas (*campos da várzea*)
C. Flooded areas (*areas alagadiças*) 1.Permanent/temporary lakes (*pirizales*) 2. Flooded savannas (*campos alagados*)	C. Discontinuous terra firme (*ribanceira*)

Terra Firme Ecosystems

In Amapá the uplands cover 77% of the state territory and a proportional percentage of the territory of Mazagão (Rodrigues dos Santos 2004). Terra firme forests (*florestas de terra firme*) cover about 70% of the landscape in Amapá and Mazagão (IEPA 2005) and the remaining terra firme areas belong to areas of tropical shrubby savanna (~6.8% of the territory of Amapá). The soils of the terra firme in Amapá are predominantly latosols (oxisols), underlying 50% of the area of the state (Rodrigues dos Santos 2004). In Mazagão terra firme soils are classified as yellow latosols (IEPA 2005), which are the most common type of latosols found in Amazonia (Falsei 1984). Yellow latosols are derived from Tertiary formations and formed by the process of continual leaching; as a result, yellow latosols have a low chemical fertility.

Soil surveys from areas near Carvão demonstrate a high level of acidity with 93% saturated by bases in all of the tests, as well as low levels of Ca_2+ and Mg_2+ in 93% of the tests. Soil phosphorous (P) was also low in all tests of these soils; however high to medium levels of organic matter were found in upper soil horizons. The soils of Carvão were found to be made up of four parts of loam (clay), three parts sand, and three parts silt (IEPA 2005). Lateritic concretions (*piçarra*) were also found in Carvão soils (IEPA 2005). Lateritic concretions are hard stony nodules commonly found in Amazonian soils of the Tertiary period and are generally associated with latosols (Falsei 1984). Carvão soils displayed *piçarra* levels at 12/kg (IEPA 2005).The cultivation of root crops, such as manioc (*Manihot escultenta*) common in the region, is hindered when piçarra levels reach 100/kg (IEPA 2005).

Terra firme forests

A recent study conducted by the *Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá* (IEPA 2005) distinguishes two types of terra firme forests in Mazagão. The first type occurs in areas where the topography is level (or flat) (*relevo aplainado*). These forests are of medium height (relative to other terra firme forests in the state), have lower tree density, and have lower tree species richness with a relatively small number of emergent species. Researchers note that these areas also have a high occurrence of the economically important bacaba palm (*Oenocarpus bacaba*).

Within the larger literature, this vegetation type corresponds to what Pires and Prance (1985) described as “open forests with palms” (under the larger category of terra firme forests in Pires and Prance’s (1985) classification of Amazonian vegetation types; this category contrasts with terra firme dense forests. The lower biomass associated with

this type is said to be caused by the lower water table, the poor permeability of soils, and the occurrence of a relatively long dry season (Pires and Prance 1985). Since these areas offer more light they are prime habitat for bacaba, lianas and other palms, such as *babaçu (Orbignya barbosiana*), *patauá* (*Jessenia bataua*), and *inajá* (*Maximiliana regia*).

Open terra firme forests are compared to forests that cover upland areas of strongly undulating topography. The latter forests host more emergent species, and thus have a higher canopy and are characterized by a higher level of tree species diversity. Some common trees species include: *cupiúba* (*Goupia glabra*), *quaruba* (*Vochysia guianensis*), *maparajub* (*Manilkara paraensis*), *jarana* (*Lecythis Poitou*) and *angelim-pedra; Hymenolobium petraeum* (IEPA 2005). Other predominant plant species include: *taxizeiros* (*Sclerolobium* sp.), *visgueiro* (*Parkia pendula*), *tauari* (*Couratari guianensis*), *matamatá* (*Eschweilera* sp.), *caripé* (*Licania heteromorpha*), *quinarana* (*Geissospermum sericeum*), *piquiá* (*Caryocar villosum*), *angelim-vermelho* (*Dinizia excelsa*), *louro* (*Nectandra* sp.), *jatobá* (*Hymeneae courbaril*), *Amapá* (*Parahancornia amapa*) and *breus*; *Protium sp*. (Pires and Prance 1985, Moran 1993, IEPA 2005). In the upland areas with lower lying depressions, typical palm species of the várzea, such as *açaí* (*Euterpe oleracea*), *buritί* (*Mauritia flexuosa*) and the timber species *andiroba* (*Carapa guianensis*) are found (IEPA 2005). Populations of these species are managed by residents who plant or transplant these economic species in the low-lying areas of the terra firme.

Terra firme savannas

The savannas of Amapá run in a north-south belt across the state. In Mazagão, small isolated areas of savanna are found in the interfluvial areas adjacent to upland forests. Within Brazil, areas of savanna vegetation are termed *cerrados.* The term also refers to a geographic region of the central plateau of Brazil, the Brazilian Cerrado, extending through the states of Goiás, Minas Gerais, and portions of Tocantins, Mato Grosso, and South Mato Grosso. Amazonian savannas are characterized by scrub vegetation interspersed with graminoid species. In contrast to the savannas of central Brazil (and the upland forests of Amazonia), Amazonian savannas are characterized by low plant diversity. This is particularly the case for Amapá, and yet these vegetation types are also known for their high levels of endemism, especially when they occur as small, discontinuous areas surrounded by upland forests. In Mazagão, three different savanna types have been identified, including *campo limpo*, *campo sujo*, and *campo cerrado.* Campo limpo refers to savannas dominated by grasses; campo sujo are areas of grass interspersed with and scrubby shrubs (<3m in height); and finally, campo cerrado are areas of discontinuous trees and shrubs with an average of 4 m in height (Moran 1993). Common plant species found in savanna ecosystems include *caimbê* (*Curatella Americana*), *cajú* (*Anacardium microçarpum*), *murici* (*Salvertia concallariodora*), *Hancornia speciosa, Qualea grandiflora, Byrsonima crassifolia, Antonia ovata* and *Tabebuia caraiba*. Common grasses include species of the genera: *Trachypogon*, *Leptocoryphium* and *Rottboellia*.

While few studies have been conducted on soils in Amazonian savannas, studies from central Brazil show that cerrado soils are predominantly highly leached latosols

(oxisols)—soils poor in chemical nutrients, such as calcium and phosphorous (Lopes and Cox 1977). Soil surveys have not been conducted in the Mazagão region; however, farmers in Carvão often complain that manioc storage roots do not develop. Carvão and Mazagão residents also believe that the savannas eventually give way to forests after repeated years of cultivation.

Areas alagadiças (campos alagados and pirizales)

In and around Carvão and Mutuacá, the terra firme is interspersed with permanently or seasonally flooded areas inundated by seasonal rains. In Amapá, geographers call these areas *areas algadiças*, flooded areas (IEPA 2005). These flooded areas can be understood as an ecological system made up of various habitats that vary in their degree of inundation. The system is made up of seasonally flooded fields (*campos alagados*), which are cut by canals, paleo-canals, and small temporary or permanent lakes. In *areas alagadiças,* small flooded forests and terra firme islands area unevenly dispersed throughout. Change in rainfall over the course of the years determines the functionality of these areas. During the height of the rains, the system fills with water and gives way to an aquatic environment, supporting aquatic plants and floating aquatics (IEPA 2005). During the driest months of the summer, from September to November, free water is restricted to the permanent lakes or canals as are the aquatic flora fauna.

The temporary and permanent lakes of the *areas alagadiças* have also been characterized by Pires and Prance (1985) as a specialized vegetation type named a *pirizal*, after one of the most common plants (a sedge) found in the lakes, locally named pirí; *Cyperus giganteus*. Pires and Prance (1985) describe the lakes as shallow with stagnant, clear waters and sandy bottoms. Pirí is commonly found in these lakes along with other

species in the Cyperaceae family. A number of floating aquatics of the following genera: *Salvinia, Eichornia, Sagittaria, Cabomba, Nymphaea, Limnanthemum,* and *Eleocharis* are also common in these habitats. The large *buritĺ* palm (*Mauritia flexuosa*) as well as a palm known as *caraná* (*Mauritia carana*) also grow along the edges of the lakes or form small island clusters in the middle of the waters. Pirizales are restricted to the estuarine region of Amazonia and are quite common in Amapá near Mazagão Velho and Carvão (Pires and Prance 1985).

As a whole, *areas algadiças* are an important complement to the parched terra firme with which they are associated. The lakes and streams act as a type of oasis for rural residents; in the edge zones of these wet areas, residents plant fruit trees and other economic species (not able to withstand the periods of low rainfall) and use the lake waters for irrigation. Likewise, many fish species and turtles, such as the maçuã turtle, are found in the pirizales (Pires and Prance 1985) and are hunted by Carvão and Mutuacá residents as part of the regional cuisine.

Várzea Ecosystems

The tidal várzeas of Amazonia, are located below the confluence of the Rio Xingu to Marajo Island in the mouth of the Amazon (state of Pará) (Pires and Prance 1985, Moran 1993), and occupy an estimated 25, 000 km^2 (Anderson and Ioris 1992). The tidal várzea areas of Amapá cover approximately 4.8% of the state's territory (Rodrigues dos Santos 2004).

Tidal várzeas are distinguished from the seasonal várzeas (Prance 1979), located in the middle and upper regions of the Amazon, by a complex flood regime that includes

daily tides (*mareas*) and seasonal floods, *lançantes* (Moran 1993, Padoch and Pinedo-Vasquez 1999).[11] Daily tides cause a daily drop in river water levels of an average 1.2 m (Pires and Prance 1985, Padoch and Pinedo-Vasquez 1999). Seasonal floods vary in degree of inundation depending on rainfall patterns upriver. Water levels generally reach their peak from March to April, or earlier in the wet winter months (Pires and Prance 1985), raising water levels 2.3 m above low water levels (Padoch and Pinedo-Vasquez 1999).

The tidal várzea environment is made up of diverse land forms created by the depositional processes of the flood regime. In the tidal estuary, high levees (*or restingas*) are created when sediments are deposited adjacent to the river's course. *Restingas* are the sites of intensive agricultural production, and thus one of the most important landforms of the tidal várzea. They are often compared to areas of locally and permanently waterlogged soils called *igápos* located behind the natural levees (Rodrigues dos Santos 2004, Meggers 1985).

As compared to the terra firme, the tidal várzea is associated with young clayish soils with a silt fraction. Recent soils surveys conducted by IEPA in 2003 show that várzea soils in the vicinity of the study areas are low humic gleys (IEPA 2003), which are

[11]According to Moran (1993), várzea ecosystems should be divided into at least three different habitats: the upper floodplain, the lower-middle floodplain, and the tidal várzea. Várzea floodplains are specific to whitewater rivers that have their headwaters in the Andean region and carry a high sediment load. The várzea floodplains are contrasted with the igápo floodplains that align black water rivers, areas that drain white sand soils and are extremely acidic (Pires and Prance 1985, Moran 1993). The term igápo also refers to low-lying areas in the várzea forests with stagnant water high in tannins with waterlogged soils. Aside from white and black water rivers, clear waters are also found in Amazonia. These rivers drain areas of the Brazilian Plateau and the Guianan Plateau and carry sediments of medium to low fertility from these geologic formations (Sioli 1951).

associated with Holocene geologic formations. Humic gleys are formed by the accumulation of recent sediments transported by periodic inundation of the muddy waters of the Amazon River and its tributaries (Falei 1974). Soil surveys in the vicinity of the Mazagão region show that tidal várzea soils display a medium level of acidity and low level of phosphorus (P) (25%). Daily flooding results in a constant renewing of nutrient elements, making soils fertile. Agriculture, however, is limited by the complex flood regime and limited area of the *restingas* where soils are not completely waterlogged. Thus, in contrast to the terra firme, agriculture in the tidal várzea is limited by the complex flood regime instead of by poor chemical fertility (Zarin 1999).

Plant biomass in the estuary is remarkably high even though plant biodiversity is much lower in tidal várzea forests as compared to várzea forests in central and western Amazon, where forests are flooded annually as opposed to daily (Moran 1993). The relatively low diversity of plants in the estuary (and the presence of dominant species) is likely attributable to the waterlogged conditions of the soils (Anderson and Ioris 1992). Here oxygen is in short supply and thus acts as a limiting factor in vegetation growth and reproduction. In the Mazagão region, residents describe the forests of the tidal várzea as open forests (*mata aberta*) in comparison to closed canopy forests (*mata fechada*) of the upper portions of the Amazon. Researchers have also noted that tidal várzea forests undergo a process of continual secondary succession. Because of the shallow root systems (the result of impeded drainage), tree falls are continuously provoked by constant flooding and winds (Anderson and Jardim 1989, Moran 1993). The ecological conditions of the tidal várzea favor the growth of a great abundance of palms of a limited number of

species, including: *murumurú* (*Astroçaryum murumuru*), *jutpati* (*Raphia taedigera*), *açaí* (*Euterpe oleracea*), *inajá* (*Maximiliana martiana)*, *bacaba* (*Oenocarpus bacaba*), *patuá* (*Jessenia bataua*), *murití* (*Mauritia flexuosa*) and *ubium* (*Geonoma* sp.). Researchers have noted in particular the frequency of monospecific stands of *açaí* and *murití* (Peters et al. 1989, Zarin 2001). "Oligarchic[12]" forests dominated by the murití palm are associated with young soils subject to frequent inundation (Peters et al. 1989, Zarin et al. 2001). They often grow behind raised leeves which create a backswamp environment (Prance 1979). Monospecific açaí stands, often intensively managed, occur in areas subject to moderate to frequent inundation and are associated with humic gleysols (Zarin et al. 2001). Peters et al. (1989) found 775 young individuals and 267 adult individuals of açaí in a 1 ha sample area. Finally, the tidal várzea forests are also rich in timber species, that are managed and extracted by Carvão and Mutuacá residents for local use and sale in urban markets: *andiroba* (*Carapa guianensis*), *virola* (*Virola surinamensis*), *pau mulato*, (*Calycophyllum spruceanum*), *seringa (Hevea brasiliensis*), *macacauba* (*Platymiscium ulei*), *cedro* (*Cedrela odorata*), *pracaxi* (*Pentaclethra macroloba*), *taperebá* (*Spondias mombin*), *tamaquare* (*Caraipa* sp.), *pataica* (*Swartzia acuminata*), *mututi* (*Pteroçarpus amazonicus*), *ananim* (*Symphonia globulifera*), *maúba* (*Licaria mahuba*), and *ventosa* (*Hernandia guianensis*).

In addition to forests, the tidal várzea is also covered by areas of inundated savanna or *campos de várzea*. Campos de várzea are low-lying tidal floodplain areas covered by emergent plant species and small shrubs (but not trees). Campos are found in

[12] Researchers developed the term oligarchic from: Gr. *Olio* = few, *archic* = dominated or ruled by (Peters et al. 1989).

areas of depressed topography and as a result are influenced by daily tides and also accumulate rainwater. Due to these two conditions, the soils of this environment are composed of young sediments of Holocene origin and have diverse physical and chemical conditions (IEPA 2005). Studies in Mazagão show a high level of organic content in the superficial soil horizons. Chemical analysis of soils near in the tidal várzea of Mazagão (under this vegetation type) display a medium level of acidity and low levels of phosphorous (P), concentrated at 25%. A majority of the plant biomass in the campos de várzea is represented by robust grasses—referred as *cararana* (false sugar cane) in Brazil. The robust grasses include *canarana peluda* (*Echinochloa polystachya*), *canarana erecta* (*E. spectabilis*), *rabo de rato* (*Hymenachne amplexicaulis*), *andrequicé* (*Leersia hexandra*), *taripucú* (*Paspalum platyaxis*), *uamá* (*Luziola spruceana*), and *muri* (*Panicum elephantipes*). Also abundant are wild rice species *Oryza perennis*, *O. alta* and O. *latifolia,* the following common grasses: *Eragrostis hypnoides*, *E. glomerata*, *Paspalum orbiculatum*, *P. guianenses*, and various species from the Cyperaceae in the *Cyperus* and *Sceleria* genera (Black 1950). Grasses in these meadows are interspersed with small shrubs and vines, such as *artemija* (*Artemisia artemisiifolia*), *algadão bravo* (*Ipomoea fistulosa*), *erva de bixo* (*Polygonum punctatum*) and *mata pasto* (*Cassia reticulata*). In Mazagão, and more generally within the Amazonian estuary, these areas are used extensively for cattle grazing, and when the size of the herd is controlled, this activity can be a sustainable use of the land.

Finally, interspersed within the tidal várzea are areas of restricted terra firme, termed *ribanceira*, which are small extensions of discontinuous interior uplands that meet the river's edge. Because of their relative elevation, areas of ribanceira are not flooded by

the tides. Within these riparian communities, these areas play a crucial role in natural resource management and livelihoods as they provide small areas for the cultivation of upland crops.

Agricultural Practices in Amazonian Peasant Societies

Since the late 1980s and early 1990s, research in ethnobotany and economic botany has provided insight into the agricultural practices in caboclo communities throughout Amazonia—an area of research that still remains understudied. In the Peruvian Amazon, researchers have found that ribereños cultivate in both terra firme and várzea environments and rely on a detailed knowledge of these environments to maintain agricultural types suited to a particular ecosystem or habitat. In the terra firme, farmers plant crops that can withstand periods of severe heat and drought and fare well in poor latosols of this zone (Hiroaka 1992). In the várzea, farmers cultivate the areas of high land—on the banks of rivers—where soils are rich in alluvial deposits. Within this relatively small area, researchers found that farmers take advantage of various land use forms to optimize cultivated plant diversity. One influential study equated agriculture in the Amazonian floodplains of Peru to the type of zonation that farmers employ in the high Andes, where crops are planted in accordance to altitude zones (Denevan 1984). As further evidence of the variation in agricultural practices within Amazonian smallholder communities, Padoch and de Jong (1992) documented 12 distinct agricultural types in the community of Santa Rosa along the Ucayali River in the Peruvian Amazon, which were combined in 39 different ways among the 46 households.

Building on this literature, researchers in the Brazilian Amazon showed that caboclo farmers in Amapá use highly specialized management techniques to overcome

the limitations of the flooded environment (Padoch and Pinedo-Vasquez 1999, Pinedo-Vasquez et al. 2002). For instance, farmers increase the area of arable land by building up soils with palm roots and leaf litter. Like their Peruvian counterparts, caboclos maintain diverse agricultural systems often in very small areas. In both systems, researchers found that farmers shift planting techniques in line with the seasonal availability of natural resources. This strategy allows families to meet both subsistence and commercial goals (Pinedo-Vasquez et al. 2002).

Shifting cultivation and variation in agricultural landscapes

Both caboclos and ribereños like their indigenous ancestors practice shifting cultivation, also known as slash and burn agriculture or swiddening (Hiroaka 1992). Shifting cultivation is widely practiced throughout the humid tropics—estimated to support 300 million people of diverse backgrounds (Kleinman et al. 1995, Scott 1998). In shifting cultivation, farmers clear an area of forest, leave the plant matter to dry and burn the vegetation (Moran 1981). During this process, plant nutrients held in plant biomass and leaf litter on the forest floor are released (Nye and Greenland 1960); thus the practice is a viable strategy for overcoming the limitations of infertile tropical soils. While the length of the fallow period varies from location to location, researchers have found that ribereño and caboclo farmers generally plant fields with annual crops from one to three years before they are replaced by perennials and natural regeneration which often continue to be managed (Denevan and Padoch 1988, Hiroaka 1992).[13]

[13] In previous years, the practice of shifting agriculture has been deemed unsustainable by conservationists and even considered among the primary causes of tropical deforestation (Kleinman et al. 1995). A growing number of experts now recognize that shifting cultivation systems are ecologically sustainable when managed correctly. Shifting cultivation is practical for smallholders because it requires few inputs from

Shifting cultivation results in a varied landscape made up of diverse vegetation assemblages. In the ribereño and caboclo system, areas of annual cropping called *roças*, *roçados* or in Peru *chacras*—are the first land use type created in this time sequence. The period of fallow in shifting agricultural systems was long considered a passive phase in farmers' management repertoire. Research from the Peruvian Amazon, first among indigenous agriculturalists and later among ribereños, showed that farmers maintain diverse cropping systems with annual crops mixed with perennial fruit trees in their agricultural fields (or swiddens). Within the last several decades, researchers showed that when annual crop yields in *chacras* declined, farmers continued to managed the fields (now turning into fallows) to encourage the growth and production of timber and fruit trees. This system re-named "swidden-fallow agriculture," is now believed to be a wide-spread practice among various rural peoples in Amazonia—caboclos, ribereños and indigenous groups (Denevan and Padoch 1988). Indeed Pinedo-Vasquez et al. (2002) reported that smallholders from Mazagão, Amapá also manage fallows for the production of fruit and timber species (Pinedo-Vasquez et al. 2002, Sears 2003). Research from Amapá indicates that farmers protect economically important tree seedlings that regenerate after a field is prepared. Farmers then continue to manage fields and fallows to promote the rapid growth of locally-valued fruit and timber species—many of whose seeds regenerate after the burning phase of shifting agriculture (Sears 2003).

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fertilizers and pesticides; and thus is one of the few truly sustainable models of agriculture used across the globe (Kleinman et al. 1995).

Biodiversity in Smallholder Agricultural Systems

As discussed in Chapter One, caboclo and ribereño agricultural systems—like smallholder agricultural landscapes across the globe—have been shown to harbor high levels of biodiversity. Researchers studying caboclo systems in Amapá illustrated that farmers maintain high levels of alpha and beta diversity on their landholdings (Pinedo-Vasquez et al. 2002). In addition to documenting cultivated plant diversity on these levels, a large body of research focuses on diversity at the level of the species. Farmers across the globe maintain "folk varieties" or landraces. Folk varieties are maintained in populations and are adapted to specific soil or environmental conditions; researchers theorize that landraces have evolved as a result of farmers' selection for agronomic traits or are chosen for nutritive or cultural purposes (Cleveland et al. 1994, Zenven 1998). Intra-specific diversity is highest among staple crops. For instance, across the globe smallholders maintain 125,000 distinct types of wheat, 90,000 rice types and 30,000 potato types (Brush 2004). Today, farmers' landraces are considered a vital crop genetic resource for the future development and improvement of modern crop varieties (Thrupp 2000).

Ethnobotanists working in Amazonia have documented high levels of intra-specific variation in manioc varieties in fields maintained by caboclos, ribereños and indigenous peoples. In her synthesis of research on manioc diversity across Amazonia, Emperarie (2002), showed that on average traditional peoples maintained on average 15 varieties of manioc on their landholdings; however, in some cases, individuals

maintained up to 50 varieties in a single field.[14] According to recent studies, intra-specific manioc diversity results from farmers' selection for morphological and agronomic traits valued for economic or cultural purposes (Elias et al. 2004). Researchers have shown that farmers' desire to maintain diversity leads them to exchange landraces over great distances of up to 300 km (Boster 1985, Emperaire et al. 2001, Elias et al. 2004); recent genetic work on manioc cultivars maintained by Amazonian farmers has shown that landraces, distinguished by farmers on the basis of morphology, also vary on the level of the genes (Elias et al. 2004). Researchers hypothesize that genetic diversity is maintained through farmers' traditional methods of exchange, but also arises from the retention of plants originating from sexually produced seeds in farmers' fields. While farmers most often propagate manioc plants from cuttings, manioc seeds are released automatically (through autochory or the explosive dehiscence of the drying fruits) and dispersed by ants (myrmecochory) in agricultural fields (Elias and McKey 2000). Farmers maintain these genetically diverse individuals (spontaneously occurring through sexual reproduction) by saving the stem to sow new fields. Furthermore, genetic work on manioc in Brazil suggests that out-crossing between manioc and its wild relatives occurs in the field. Hybridization between crop varieties and its wild relatives also contributes to the high genetic variability of the species (Elias et al. 2004).

[14] Comparing the average number of varieties maintained by farmers in the Brazilian Amazon, Emperaire (2002) did not find a significant difference between indigenous and caboclo fields. However, the latter groups were found to maintain much higher varietal diversity than recent migrant, *colono*, farmers who settled in Amazonia after 1970.

Summary

In summary, this chapter described the ecology of the Mazagão region and thus provided the background information necessary to understand current agricultural practices and wider patterns of natural resource management in the communities of Carvão and Mutuacá. In Chapter Three, agricultural practices and patterns of plant management in the study area will be compared to the findings summarized in this chapter.

CHAPTER THREE: Agricultural Practices and Patterns of Agrobiodiversity in Carvão and Mutuacá, Brazil

Introduction

Building on the background information presented in Chapter Two, this chapter describes the state of agriculture and cultivated plant diversity in Carvão and Mutuacá. Over the past 15 years, Carvão and Mutuacá have been affected by various social and political processes—namely urbanization, land reform, and government restructuring (decentralization). These changes have brought both new challenges and opportunities to area residents. Decentralization and new social policies benefiting the rural poor have provided residents with increased opportunities to earn cash income. The growth of nearby cities all within 50 km of the study area, such as Mazagão Novo, Santana and Macapá, has increased local demand for várzea products, in particular açaí fruits (*Euterpe oleracea*). At the same time, farmers in Carvão have lost markets for products traditionally produced in the terra firme (i.e. manioc derived products).

These broad economic changes have led to two observable shifts in how residents in the study area manage plant resources. In Carvão, farmers are replacing income earned through the sale of manioc products with urban income in the form of wages, pensions, and welfare benefits. Whereas in the recent past (from the 1970s to the mid-1990s) all families earned cash income by selling farm products, results from household economic surveys conducted in 2005 revealed that agriculture today is a subsistence activity; in fact, only eight families out of the 44 farming families identified sell manioc products on a regular basis. In addition, while ten years ago the average size of fields was no less than 0.8 ha, today the average field size is 0.4 ha. Farmers in Carvão often pointed to the large

expanse of secondary forests (*capoeira*) along community roads and pathways as evidence that agriculture was once much more "developed" in the region.

In Mutuacá, on the other hand, farmers are increasing açaí production on their lands to meet new urban demands. Farmers are both increasing the extent of existing açaí stands (*açaízais*) and planting açaí seedlings in newly cleared areas and in secondary forests. Furthermore, results from household economic surveys in Mutuacá indicate that because farmers are preoccupied with on açaí production, many are giving up subsistence farming in diverse land-use types.

In light of these observed shifts, this chapter examines the nature of agricultural practices and patterns of agrobiodiversity in the study area. The main objective is to determine if despite observed socio-economic changes levels of agrobiodiversity are high as compared to levels recorded by ethnobotanists studying in similar peasant communities across Amazonia. As discussed in Chapter One, scientists have largely found that market integration and de-agrarianization are associated with the erosion of local agrobiodiversity (Cleveland et al. 1994, Henrich 1997, Peroni and Hanazak 2002). Because of their importance and role in maintaining agrobiodiversity (Brush 1995; 2004) I also describe farmers' management strategies in both communities.

This chapter unfolds in the two sections. In the first, I describe land use types[15] maintained by farmers in Carvão and Mutuacá. I also describe how these land use types

[15] Following Brookfield et al. (2002) land-use types (also land use stages) are areas of land designated for a specific land use and distinguished on the basis of vegetation structure. These areas are recognized on a landscape level as equivalent ecosystems. Land use types consist of large categories, such as managed forests, areas of annual cropping, fallows, and home gardens. The above authors also recognize field types, as variants of land use types. For instance, variants of annual fields are monocultures or polycultures.

are related to one another. In both communities I describe farmers' management strategies and techniques used to maintain agricultural types. In the second half of the chapter, I report the results of plant surveys of agricultural fields and home gardens in Carvão and Mutuacá. I also discuss the results of diversity analysis, which includes calculations of plant species richness, evenness and β-diversity calculations for each sample area. Importance values for all woody species are calculated for both sample areas.

Methods

Data for this chapter were gathered using four methods: household economic surveys, property visits, participant observation, and vegetation sampling. Data on agricultural operations and farmers' management techniques were gathered through household economic surveys conducted from 2005 to 2007 in the study area. An analysis of household economic surveys allowed me to distinguish households on the basis of major resource management activities. After identifying the farmers in both communities, I visited 36 properties (19 in Carvão and 17 in Mutuacá).[16] During site visits, I conducted "in-field" interviews on agricultural operations and management strategies and land use history of the property; site visits also allowed me to identify and quantify land use types and field types maintained by farmers in the community. In 2007, I inventoried annual fields and home gardens on a total of 39 properties between the two communities. Protocols for inventorying cultivated plants, based on the recommendations of Brookfield et al. (2002) for identifying and documenting agrobiodiversity, are described below.

Researchers such as Pinedo-Vasquez et al. (2002) and Brush (2004) have shown that variation in land use types and field types is positively associated with high levels of cultivated plant diversity.

[16] Properties were selected on the basis of farmers' willingness to participate in the survey.

Agrobiodiversity sampling in home gardens

Plant diversity was documented in 14 home gardens in Mutuacá (representing 56% of all farming families in the community) and 18 home gardens in Carvão (representing 40% of all agricultural families in the community); inventoried home gardens were chosen by a random selection of all the gardens previously recorded during farm visits. In both sites, home gardens were measured and all plant species cultivated or protected were recorded. For each species, data were collected on: species name, abundance, habit, and primary and secondary economic uses. To gain a better sense of the ecological parameters of these spaces, I measured the diameter at breast height (DBH) and estimated plant height for all trees greater than or equal to 2.5 cm DBH. For each species and variety identified in fields and home gardens, a voucher specimen (to verify the identification) was collected for deposit in the state herbarium of Amapá located in the city of Fazendinha and run by the *Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá* – IEPA (The Institute for Research and Technology of Amapá).[17] Species identifications were verified with the aid of botanists at IEPA and by consulting local herbarium collections. Botanical nomenclature was verified with the use of online databases of the New York Botanical Garden (i.e. http://www.nybg.org/bsci/acre/) and the International Plant Names Index < http://www.ipni.org/index.html>.

For each home garden inventoried, plant species richness was calculated (number of species). [18] Correlation coefficients (Pearson) [19] between plant species richness,

[17] Permission to collect and transport plant materials from the study site to the state herbarium in Fazendinha was granted by the *Secretaria do Meio Ambiente do Amapá*-SEMA on February 15, 2007 for a period of three months.

[18] All but eight species were identified to families in both sample areas. On the basis of *morphospecies,* unidentified individuals were included in the richness and other diversity indices.

number of individuals in home gardens, area of the gardens (ha), farmer age, farmer residency, and stable monthly income ($R) were then calculated at the household level. For each sample area (Carvão and Mutuacá), plant species richness and evenness (Shannon diversity index),[20] and β-diversity[21] values were also calculated.[22] Phytosociological parameters and importance values for all woody species with a diameter at breast height (DBH) greater than or equal to 2.5 cm were recorded (for each sample area), according to the methods described in Curtis and Macintosh (1951). Finally, analysis of variance (ANOVA) was used to compare the mean number of species in home gardens in Carvão and Mutuacá.[23]

Fields

Areas of annual cropping were inventoried on a total of 14 different properties in Carvão, which were chosen by random selection. These properties were chosen at random from the 44 residents who maintain annual fields (and who were identified during household economic surveys). From this total area of 7.42 ha, plants were inventoried in 56 10 x 10

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[19] Peason's Correlation Coefficient reflects the degree of the linear relationship between two variables; a simple form of the formula is $r = \sum Z_x * Z_y / N$ - where z_x is the variable X converted into z scores and z_y is the variable Y converted into z scores. Refer to Fowler et al. (1998) for further reference.

[20] Shannon Diversity index is a measure of species diversity and evenness and is found using the following formula:

$$H' = -\sum_{i=1}^{s} p_i \ln(p_i)$$

S is defined as the number of species and p_i is the relative abundance of each species, calculated as the proportion of individuals of a given species to the total number of individuals in the community (n_i/N). N = the total number of individuals and n_i = the abundance of each species (Magurran 2004).

[21] β-Diversity identifites differences in species composition between plots or sub-plots within a sample or group of samples. β-Diversity can be described as a measure of species turnover between sample areas. In this study, I used Whittakers' formula: $\beta = S/\alpha - 1$, where s = total number of species found in each sample and α = the average number of species in each sub-sample (Coffey 2002).

[22] Diversity indices were calculated using Microsoft Excel. Correlation coefficients and ANOVA calculations were conducted using Excel statistical analyses tools.

[23] See Fowler et al. (1998) for a reference on analysis of variance (ANOVA).

m plots (out of 14 fields/four from each field). Plots were located by choosing coordinates using a random numbers table. In Mutuacá, I surveyed annual fields (100% of all the fields maintained by the 17 interviewed households); of the total area (1.39 ha) in annual cropping, plants were inventoried in 16 10 x 10 m plots (four from each field). For all cultivated or protected species and varieties found, I recorded common names, growth habit, and primary uses. Voucher specimens for each species and variety identified were deposited in the state herbarium of Amapá. To examine manioc varietal diversity and understand how farmers distinguish between landraces, I gathered morphological and agronomic data on each variety. [24] Following the recommendations of Elias et al. (2001), I measured plant height and recorded observations on plant structure and branching patterns in each field where a variety was encountered. From a sample of dry materials, I calculated the average length and width of the leaves, the length of the petiole, and made observations on leaf, stem, petiole color and structure from 15 vouchers of each variety.

Results: Land use Types Identified in Carvão

The landscape of Carvão is made up a variety of land use and field types, including native terra firme forests (*mata brava* or *mata virgem*), agricultural fallows (*capoeira*), secondary forests, agricultural fields (*roças*), home gardens, and monospecific palm stands dominated by the bacaba palm—*bacabal*, plural, *bacabais*. (Figure 3.1, Table 3.1).

[24] Boster (1985) and Elias et al. (2001) report that color variables—especially the color of the stem, the color of the petioles, and the color of the root—are most important to farmers when distinguishing differences crop varieties. Alves (2002) argues that morphological characteristics as opposed to agronomic qualities are on average retained to a higher degree in the F-2 generation.

The vegetation types indentified in the sample area are related to one another in space and time through natural forest succession processes and farmers' management strategies.

Forests, fallows and managed fallows (bacabais)

Carvão residents identify areas of *mata braba,* as forest tracts that have not been affected by anthropogenic processes, at least in the owners' lifetime or memory. Within the vicinity of the community, both types of upland forest described in Chapter Two, both those with higher tree density and those with lower tree density, are found. Areas of fallow, *capoeria alta* or *capoeira baixa*, are on the other hand, derived from previous agricultural practices. According to farmers in Carvão, the *bacaba* palm (*Oenocarpus bacaba*) commonly regenerates in agricultural fallows. Because of the economic value of bacaba fruits and their importance to the local diet,[25] farmers manage these fallows for its reproduction. Management techniques include thinning back vines and shrubs that compete for limited resources and interfere with the growth of the palm. Over time, bacaba palms accumulate in agricultural fallows and form bacabais—monospecific *bacaba* stands. Once bacabais become established, farmers conserve the palms in the landscape, never returning to cultivate in this area.

Agricultural fields and home gardens

Agricultural fields in Carvão are characterized by low species diversity—with one to four crop species planted at a time. Among the 14 families interviewed in 2007, the range in area maintained in annual crops was 0.2 to 1.4 ha. Household economic surveys and property visits indicate that most fields contain monocultures of manioc (*mandioca*),

[25] The soft fruits of bacaba are mashed into a wet pulp and mixed with water. The juice is mixed with farinha and eaten as gruel with fish, meat or chicken—and like *vinho de açaí* is a dietary staple in the region.

Mainhot esculenta (Table 3.1). Manioc is planted in Carvão for the production of various products, produced in areas called *casas de farinha* or *retiros.*[26] Finally, home gardens (*quintal* or plural *quintais*) in Carvão are located in the vicinity of residents' homes, in house-lots and vary in area from 0.05 to 0.9 ha. Home gardens are characterized by a high degree of variability in habitat areas or field types, including mixed perennial fruit orchards, herb and vegetable gardens; home gardens are multi-tiered, as farmers plant shade-tolerant herbs under woody species throughout the space. Farmers cultivate herbs under trees or against tree trunks or any in other microenvironments that favor the growth the species. Of all of the land use types, home gardens in Carvão are the most intensely managed.

[26] A *retiro* is the regional term that describes a simple hut where bitter manioc root is processed into manioc flour. Residents use the word retiro interchangeably with *casa de farinha* (house of manioc flour). Manioc is primarily grown for the production of *farinha,* coarse manioc flour, processed from manioc roots through a long and labor-intensive process. Residents also produce *tapioca*, a gummy mass also derived from manioc root, used to make manioc pancakes (*tapioquina*). Another popular product is *tucupi*, a sauce made from the liquid extracted during manioc processing and combined with various spices, such as hot peppers.

Figure 3.1. Land use types identified and quantified in Carvão, Brazil on a total of 19 properties.

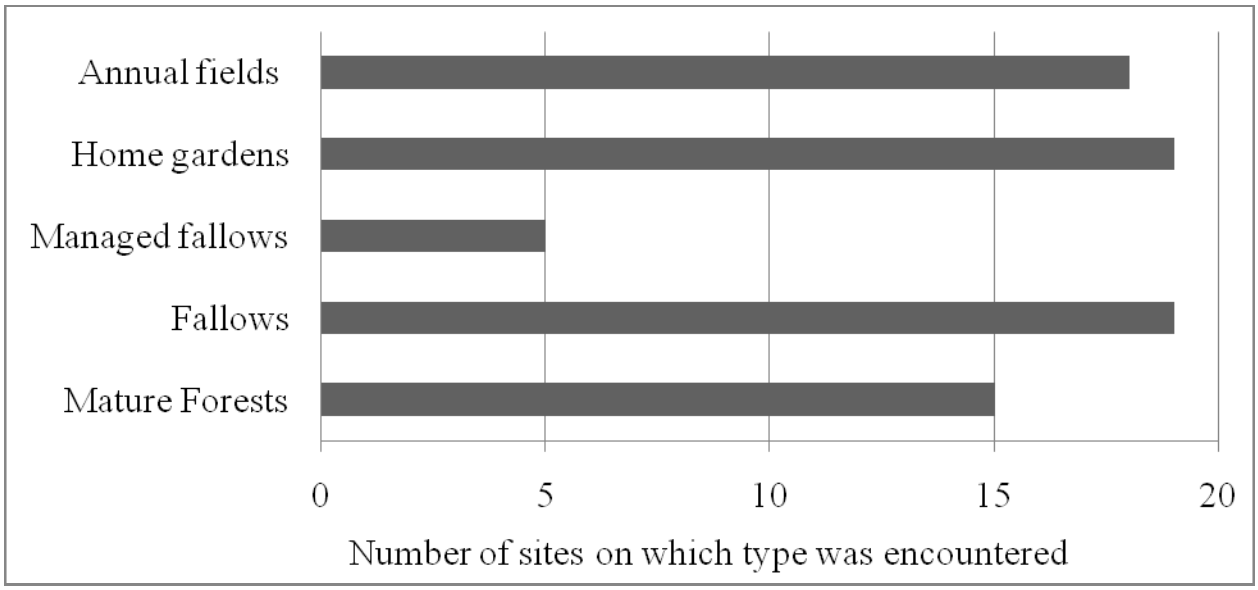

Table 3.1. Land use types and field types identified and quantified in Carvão, Brazil on a total of 19 properties.

Vegetation type	**Field types (variants)**	**Number of properties on which land use type is present (2005-2006)**
Native Forest (*mata brava, mata virgem*)	---	15
Agricultural fallows (*capoeira*)	-Young fallows (>10 yrs) (capoeria baixa) (19) -Old fallows (<10 yrs) (capoeira alta) -Old fallow with bacaba stands (*bacaba*l)	19
Agricultural fields (*roça*)	-Manioc (18) -Pineapple (3) -Watermelon (1) -Manioc with pineapple (1) -Manioc with corn (1) -Manioc with corn, squash and yam (cará do indio) (1)	18
Home gardens (*quintal* or plural *quintais*)	-Mixed perennial orchards -Herb and vegetable patches	19

Farmers' Management Strategies: Agricultural fields (*roças*)

Preparation of the Roça

Each year at the end of the dry season, in late October or early November, farmers clear an area of secondary forest, or rarely an area of mature forest, to form the new roça. Decisions on where to place the annual roça are based on a number of factors, such as the size of the farmers' landholdings and the age of forest (or fallow) on different areas of the property. Farmers in Carvão allow an old roça to remain in fallow from three to 15 years (depending on farmers' access to land). In considering the placement of the field, farmers also take into account distance to roads, which determine the ease with which sacks of manioc roots can be carried to the *casas de farinha* for processing.

With the chosen area, farmers begin to clear standing vegetation in a systematic fashion, working individually or more often in groups of two to five. Due to labor shortages (the result of out-migration and young people's unwillingness to farm), [27] many heads of household hire agricultural day laborers (paid the daily wage of 10 to 15 R$) to help remove large trees that typically grow in old fallows or mature forests.[28] Farmers first clear trees with the largest girth with axes and then clear the remaining trees, shrubs, vines, and herbs with axes or machetes. When possible, farmers create a "bed" with large palm leaves that later serve as kindling in the burn. The brush is then left to dry for several weeks before the mass is burned. Before burning day, some farmers prepare firebreaks around the perimeter of the field to prevent the fire from spreading into the

[27] The causes of labor shortages are described in more detail in Chapter Six.

[28] Farmers sometimes hire community members who own chainsaws to fell large trees. This practice is not very common. In 2007, for instance, no farmers out of the 15 interviewed reported to hire chainsaw operators to help prepare their fields.

forests and savannas.[29] After the brush is burned, farmers pile up the remaining charred logs into piles, dig up the unburned roots and add them to the piles. This process is locally referred to as *encoivarar*—to pile up charred logs—and clears adequate space for the sowing of manioc and other crops.

After burning and *encoivara*, fields are sown with manioc and sometimes with other crops (though this is rare in Carvão today). The process of manioc cultivation—from seed selection, sowing, weeding, harvesting, and post-production processing of manioc into farinha—is described below. Later I briefly describe the production processes for other crops, including corn, watermelon and pineapple.

Planting manioc fields

Sowing of manioc fields begins at the end of dry season, beginning in late December. Planting at the end of the summer allows manioc plants to germinate and establish themselves in the soil before the winter rains arrive in full force at the beginning of January. If the rains are delayed by more than three weeks, as was the case in 2006 and 2007, farmers will lose the first planting and must either replant their fields in February and March or decide to forgo manioc production for the year.[30] Planting is usually conducted in small groups using of two different methods. In a system considered more

[29]Brazil's environmental regulatory agency, the *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* (IBAMA) requires the use of firebreaks. However, because farmers in Carvão clear small areas for agriculture, producers are usually exempt from many of these regulations. Most farmers complain that the rules are vague and that they have inadequate information to inform them of how to comply with environmental regulations.

[30] In 2006, the late rains destroyed the first manioc crop for many in Carvão. Because many farmers did not replant their fields in 2006, in 2007 when I returned to Carvão, many residents spoke of a community-wide shortage of farinha. Many families—accustomed to producing their own farinha—were buying farinha imported from the state of Pará from merchants in Mazagão Novo and Macapá.

"traditional," farmers work in pairs; one person in the pair turns over the soil with a garden hoe, creating a small depression in the ground (this person is called the *virador*, or the person who turns over the soil). The second person in the pair then places the manioc stem (seed) in the depression and covers it with soil.[31] More commonly, however, in a system that is referred to as planting *de ferro,* farmers work by themselves, digging a small hole with the manioc stem itself and dropping the stem in the ground. Farmers either plant their manioc in straight lines[32] (*na linea*) or scattered throughout the field using a method called *ferro jogado*. In either case, farmers say that for the roots to develop, plants need to be placed at least one "*passo*" (step) apart, which is equivalent to 1.25 meters. Finally, depending on labor availability, farmers work either individually or in small groups. In 2007, for fields measuring 0.5 ha and out of 15 informants, farmers said they planted their fields in as little as two days or as long as a month[33] depending on the number of people available for planting.

With the fields planted, farmers engage in other activities until weeds begin to grow. Weeding is one of the most time-consuming tasks of all the agricultural operations. Thus, farmers will often hire agricultural day laborers to expedite this process.[34] When

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[31] Older farmers report that when they were younger and more people made a living from farming, large extended families would gather to plant the manioc field. In this system, women carrying baskets full of manioc stems would follow the men, the *viradores*, who were turning over the soil, and would place the manioc stems in the small depression. Farmers say that the five rows of male and female teams working together could plant up to 0.5 ha in just one day.

[32] The practice of planting manioc in rows is a technique farmers learned from agricultural extension agents –both from the state institution, RURAP, and the federal extension agency, EMPRAPA. In the 1970s and 1980s, agricultural extension agents were more actively involved in the rural communities; many farmers benefited from field training sessions (*dias de campo*). Farmers sometimes choose to incorporate "learned" practices that they self-test and find useful. When the methods are found unsuitable, farmers ignore the advice of the technicians.

[33] This was the case for an elderly farmer who works alone.

[34] Farmers explain that weeds grow more quickly and abundantly in fields that were previously young fallows (*capoeira baixa*). Fields prepared in older fallows or mature forests, on the other hand, are less weedy; in addition, fields planted in the sandy soils of the savanna also yield fewer weeds.

weeds grow voraciously and restrict the growth of manioc plants, farmers remove them with machetes and garden hoes (in the case of deep rooted plants) during the morning hours from 6 AM to 10:30 AM. Farmers leave uprooted weeds in the fields to serve as natural fertilizer (*adubo*) for the soil. Farmers weed their fields each day until the field is "cleaned;" when manioc plants become large enough they restrict the growth of the weeds, and weeding is no longer necessary. Farmers in Carvão reported that fields need to be weeded twice before the plants reach maturity.

In addition to weeds, farmers reported that leaf-cutter ants (*saúva*, various species in the genera, *Atta* and *Acromyrmex*) are common agricultural pests. When leaf-cutter ants attack a field, they are capable of defoliating entire sections of the field in a matter of days. To prevent crop loss, farmers routinely search for ant colonies in their fields and poison the nests to either kill the ants or drive them away. Farmers most commonly pour the bitter extracts from manioc roots, which are rich in toxic cyanogenic glucosides, on the nests. Other farmers make a solution from the smashed root of *timbó* (*Lonchocarpus urucu*), which contains the insecticide rotenone for use against saúva. In addition, a few farmers purchased a chemical insecticide "Mirmex" to rid their fields of ants. Farmers report that once an area is treated ants generally do not return.

Aside from saúva, manioc plants rarely suffer from other insect attacks. Agricultural extension agents report that pest populations are kept at bay because of the nature of the farming system, which is characterized by very small fields in a diverse landscape; farmers do report that small game, mainly *cutia* (*Dasyprocta* sp.) eat manioc

roots; when farmers observe animal tracks in their field, or evidence of the cutia, they will stalk the animals at night and hunt game with their rifles.

Depending on the variety planted, farmers begin to harvest manioc in as few as eight months and up to two years (see discussion below on varietal diversity in Carvão).[35] When roots reach maturity, farmers harvest a specific quantity to meet the family's immediate production goals. For instance, if a family wants to produce one sack of farinha (equivalent to 80 liters or approximately 75 kilos), a quantity consumed in 15 to 30 days by families with five members, the farmers will uproot two to three burlap sacks of manioc roots. When farmers uproot the first manioc crop, they replant the stems, using the harvested material. With this pattern of replanting, by the time the first crop has been harvested, the field has already been replanted. Given this system, a farmer may have three manioc roças in production—an area that has recently been planted (*roça nova*), the field with the second, replanted crop (*roça de replanta*), and a third area being harvested (but not replanted) (*roça velha* or roça *acabando*). For instance, of the 15 farmers that I interviewed in 2007, four had one area under production (these were families that had lost their crop to rains in 2006). Seven had two types of fields—roças novas and roças de replanta—and two had fields of all three different ages.

Most farmers reported that seed material for planting the first and second crop is derived from their own fields. Seed material for the second cropping almost always comes from the material being harvested. To plant new fields, farmers save material from

[35] Manioc fields do not require irrigation, as the plants are well-adapted to the dry, acidic soils of the terra firme. However, in wetter climates, where rain falls periodically during the dry season, such as in the western Amazon, the roots grow larger and yield more farinha (Alves 2002).

older roças. In describing their selection process, farmers explained that they take notice of plants with desirable agronomic traits and save material from these plants for future cultivation. Farmers either reserve individuals in the field or when harvesting manioc plants move the stems of desirable plants to the home garden for storage.

On the other hand, if farmers are without adequate seed material to plant a new field, producers look for seed beyond their immediate properties. In 2007, for instance, having lost their 2006 manioc crops to delayed rains, many farmers were without seed material. In this case, farmers obtained stems from neighbors' or relatives' fields; many farmers with whom I spoke had even gathered manioc stems from farmers in Caimaipai and Piquizal, two nearby upland farming communities. Moreover, a large roça in the Queimada section of Carvão, abandoned because of a land dispute between relatives, provided seed material for many seedless farmers in Carvão from 2006 to 2007.

While residents produce a number of different products from manioc root, farinha is by far the most common. Farinha is produced through a long process that involves four steps: peeling the roots, grating or shredding the roots, extracting the toxic cyanogenic glucosides from the shredded mass (with either a wooden press or a woven sieve (a *tipiti*), [36] and toasting the pulp on a large wood-heated surface (*forno*) to yield the final product.[37] In observing the post-harvest processing of farinha, I recorded several variations to this generalized process. For the most part, the work of peeling is considered the domain of women and children. Children as young as five help peel roots; however

[36] A *tipiti* is a cylindrical woven device usually constructed from the leaves of the *buritĺ* palm (*Mauritia flexuosa*) and used to squeeze out the poisonous liquid from the grated manioc mass.
[37] See Wagely (1954: 66-67) for detailed description of this process.

men may also participate. The operating of the electric shredder is generally considered the domain of men. After shredding, the bitter compounds are removed with a tipití or wooden press. The use of the tipiti is more common and facilitates the capture of the bitter manioc juice that is later processed into *tucupi.* Some families will shred manioc roots directly after transporting them back from the field and subsequently extract the bitter compounds. Others soak roots in water for one to four days; these disintegrated roots (called *puba*) will then be added to the shredded mass of fresh roots and processed using the same methods. The latter method is considered more traditional and referred to locally as making farinha "*de molho*" (processing farinha through soaking). Because it is more time consuming, few families in Carvão continue to process farinha in this fashion.

Growing corn, pineapple and watermelon in Carvão

Farmers in Carvão also plant pineapple (*abacaxi*), watermelon (*melancia*), corn (*milho*) and beans (*feijão*) in annual fields made in forest clearings. Like manioc, corn is sown at the beginning of the rainy season, and in all cases in Carvão was planted interspersed with manioc plants. Farmers derive the seed material from their own fields. Producers place two to three seeds in thin depressions in the soil to ensure that at least one plant germinates. Corn is a fast-growing plant, which is ready to be harvested in just three months. After harvesting, farmers often save corn seed in the field; farmers flip the corn stalk (infructescence) downward so that rain slides down the stalk. Farmers report that seed conserved in the field is less likely to perish. Farmers who plant corn most often use the grain as feed for chickens that are raised in home gardens.

Pineapple and watermelon are grown in small patches measuring no more than 30 square meters. Farmers plant watermelon of two different varieties in May; the fruit is harvested just three months later. Pineapple, on the other hand, is planted in December or January. In the study area, pineapple plants generally yield one to three crops.[38] Despite the popularity of these fruits in Carvão, watermelon and pineapple production is in decline. In 2005, two farmers planted small watermelon patches. In 2007, nobody had planned to cultivate watermelon, and just two farmers were planting pineapple. Many farmers told me that they had given up both watermelon and pineapple production due to rampant theft. Others replied that they do not have the labor to commit to diverse types of production (and can manage only to cultivate manioc). However in one exceptional case, farmer planted 10 ha of pineapple in area near the entrance to Carvão in 2007. This farmer sells pineapple bi-weekly at the state-sponsored market in Macapá, and told me that even though he no longer needs to farm (as he and his wife receive pensions from the government as rural workers), he likes to take advantage of his land, and not have it simply "lying there unproductive."[39]

Land use Types Identified in Mutuacá

Farm visits and interviews with Mutuacá residents indicate that farmers maintain various land use types on their properties. Just as in Carvão, these land use categories have different vegetation assemblages and play a specific role in the local management regime. In 2007, I conducted 12 property visits (which included 17 households because extended

[38] Pineapple plants can remain productive for more than three years; however, much of the germplasm that farmers receive in Carvão is infected with the fungus *Thielaviopsis paradoxa*, which gives the plants a disease that farmers called, "*Podridão negra*," (Rotted black) because the fungus turns the fruit black from the inside out.

[39] Sr. Geraldo, Carvão.

kin often live on the same property) and identified the following land use types: mature tidal várzea forests (*mata brava* or *mata virgem*), fallows, both young and old, where forests are regenerating (*capoeira baixa* and *capoeira alta*), managed forests with a high abundance of açaí, home gardens, and annual agricultural fields, *roçados* (Figure 3.2 and Table 3.2). Like in Carvão, land use types are linked to one another in space and time and are the outcome of specific management practices. Below I describe both the process of landscape change occurring in Mutuacá and the major characteristics of land use types found in the community.

Figure 3.2. Land use types identified and quantified in Mutuacá, Brazil on a total of 12 properties.

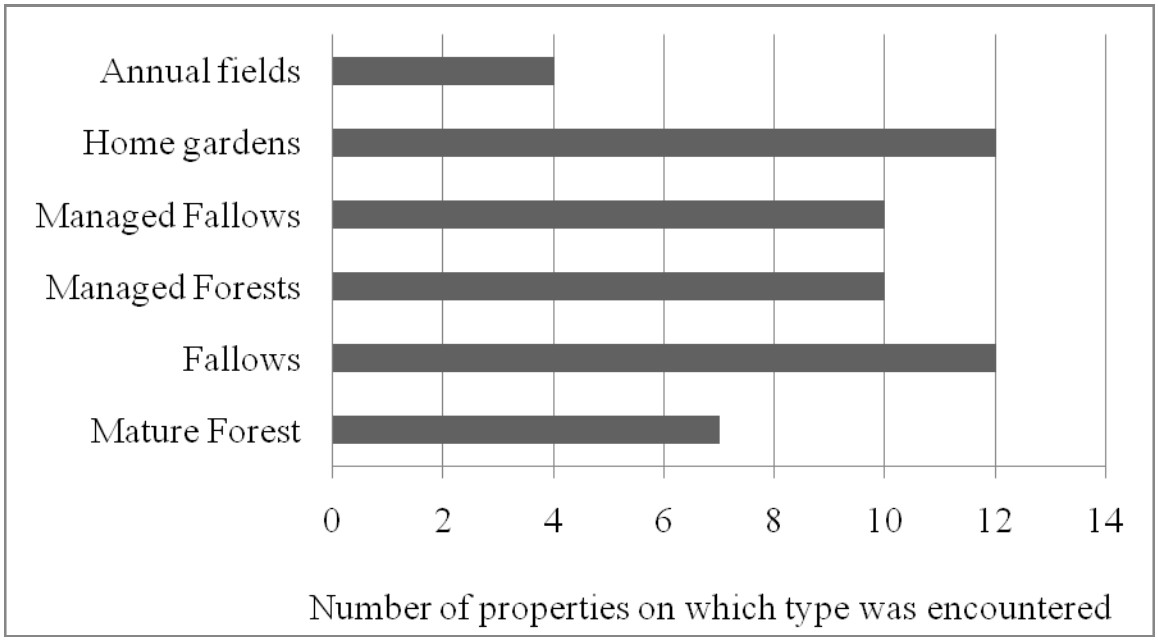

Table 3.2. Land use types and field types identified and quantified in Mutuacá, Brazil on a total of 12 properties.

Vegetation type	**Field types (variants)**	**Number of properties on which type is present (2007)**
Mature várzea forests	-Managed forests for açaí	10
Unmanaged Forest fallows	-Young fallows (>10 yrs) (*capoeria baixa)* -Old fallows (<10 yrs) (*capoeira alta*)	12
Mixed home gardens with an *açaízal*	-Mixed perennial fruit trees -Monotypic stands of açaí (açaízal) -Herb and vegetable beds on raised beds	12
Agricultural fields	-Corn	4

Changes in Farming Practices and Landscape Patterns

In recent years, increased local demand for açaí fruits in area cities (i.e. Mazagão Novo, Santana, and Macapá) has prompted farmers in Mutuacá to increase açaí production on their lands.[40] Interviews with farmers and visits to their properties, revealed that they are increasing the production of açaí through the following methods: planting açaí in newly cleared areas (among annual crops), in secondary forests (*capoeiras*), and in home gardens. Residents also manage native várzea forests to increase açaí fruit production. Based on farmers' estimates, property owners maintain from 6 to 13 ha in intensively managed açaí stands (*açaízais*); these calculations however do not include areas of várzea forest managed for açaí. Interviews with farmers indicate that the cultivation and management of açaí that is occurring in Mutuacá appear to be replacing forms of agriculture. Below I describe this process of change characterized by the disappearance of mixed annual fields (*roçados*).

According to residents, in the past, farmers engaged in swidden-fallow cultivation that involved a series of steps described in Chapter Two. As is typical of this system, farmers first cleared and burned an area of forested vegetation on the *restinga* (along streams and on riverbanks).[41] Later with the land prepared, farmers planted their roçados— mixed agricultural fields characterized by a relatively high level of plant

[40] The *açaí* boom in Amapá is part of a larger phenomenon occurring in Amazonia linked to the expansion of regional cities, but also to increasing national and international demand for açaí. Today açaí is being marketed as a health food and consumed by urbanites in Brazil, Europe, and the United States (Anderson and Ioris 1992, Murrieta et al. 1992, Peters 1992, Brondizio and Siqueira 1997 and Brondizio et al. 2002). Farmers have responded to this demand by increasing production of açaí on their properties. Researchers call this phenomenon the *acaízação* or acaization (Hiroaka 1994) of the estuary, which refers to the increasing dominance of the açaí palm in várzea forests in the region.

[41] The process described below is based on interviews with farmers in Mutuacá.

species diversity.[42] In late December or early January, farmers then planted a first cycle of corn and beans, along with semi-annual and perennial plants, such papaya; *mamão* (*Carica papaya*), *mandioca*; *macaxiera*; sweet manioc (*Manihot esculenta*), *banana* (*Musa* sp.), *limão* (*Citrus limon*), *pimenta* (*Caspicum* sp.), *jerimú* (*Curcurbita* sp.) and other woody fruit trees the farmer desired for future use.[43] Farmers would then harvest the squash and corn after three months. Later during the month of May, farmers cultivated plants such as, *melancia;* watermelon (*Citrullus lanatus*) and *maxixe* (*Cucumis* sp.). Farmers explained that once the watermelon spread across the ground, they planted a second round of corn. [44]At the onset of the second cropping, farmers then planted additional fruit trees. When the last of the annual crops were harvested, the roçado, now transitioning into a managed fallowed, was manipulated for the growth of fruit trees and other perennial species of economic value spontaneously occurring in the fallow. For instance, farmers often conserved saplings of *pau mulato* (*Calycophyllum spruceanum*) in managed forests (Sears 2003).[45] Plants cultivated in mixed roçados were reserved for subsistence purposes; however, at different times some products were marketed locally.

While the roçado was once quite common in Mutuacá, property visits in 2007 revealed that nobody was maintaining a "true" roçado. All "roçados" documented in 2007 were monocultures of corn (beans were also planted but harvested before I

[42] The roçado as described here has been documented by previous researchers working in the vicinity of the study site (c.f. Pinedo-Vasquez et al. 2002). The roçado bears resemblance to the *chacra* maintained by ribereños in the Peruvian Amazon.
[43] Additional crops such as potatoes (*cará do indio*; *Dioscorea trifida*) were also integrated into the cropping cycle.
[44] Farmers report that watermelon should be harvested before the second corn crop begins to flower. The pollen from the corn is said to kill watermelon and other fruits in the Cucurbitaceae family.
[45] Refer to Appendix 3.2: Epistemologies of Plant Health and Disease for more information on growing plants in várzea roçados.

conducted plant surveys) and two small sugarcane (*cana*) patches in home gardens. All farmers interviewed explained that they had prepared these areas with the intention of planting açaí seedlings between annual crops (which they later did beginning in March of 2007). Farmers further explained that they had planted corn and beans so that land was not "wasted" during the time the açaí seedlings grew to a productive age (in about three years).[46] Açaí seedlings sown in March would later be supplemented with second crop of corn.[47] Along with açaí seedlings, some farmers were also planting other economically important plants, such as *cupuaçu* (*Theobroma grandiflorum*) and *cacao;* cacao (*T. cacao*), two plants which are noted for growing successfully among açaí stands. In some cases, farmers augmented existing home gardens by planting açaí seedlings. Other times, the new açaízal is set away from the house-lot, as a separate agricultural area. In either case, new açaízais become permanent fixtures in the landscape.

Home gardens

In addition to roçados and new açaízais, home gardens are a common land use type found in Mutuacá. Home gardens generally consist of three separate areas, in which different types of plants are cultivated. Directly next to the house, female farmers cultivate herbaceous and semi-herbaceous plants, and shrubs of medicinal or culinary value. These plants tend to be grown on raised beds, which protect the more delicate species from waterlogged soils. Close to the residence, farmers also store seeds and produce tree seedlings with economic value. Outside of the herb and vegetable garden, much of the remaining space is being converted to açaí-dominated orchards (*açaízais*). Results from

[46] Translated from Portuguese: "*so para não estragar a terra…em quanto o açaí desenvolve…*"
[47] Açaí seedlings were either produced by the farmers themselves from seed or transplanted from the forests where they regenerate spontaneously. Farmers reported that planting açaí among corn plants served a tertiary goal of protecting young seedlings.

property visits and in-field measurements revealed that managed açaí stands have an average density of 1.3 individuals/m.

Farmers' Management Strategies: Planting and Managing Açaí

Açaí on farmers' properties has either been directly planted by farmers or is derived from native stands. Famers either plant açaí in newly prepared fields or in areas of regenerating forests. Farmers refer to açaí planted in these areas as *açaí de planta* (planted açaí). Açaí seedlings are planted from three to four meters apart, so that they will receive a considerable amount of light. Farmers believe that açaí seedlings planted in the sun mature more quickly becoming productive in about three years (as opposed to ten years in the forest). *Açaí de planta* produces fruit all year long, including outside of the regular fruiting season that lasts from July to December. By planting açaí throughout their properties, caboclo families secure a continuous year-round supply of açaí fruits for home consumption.

Managing the forest for açaí

In addition to the areas newly planted and the açaízais of the home gardens, residents also manage the várzea forests for the growth of açaí. In these spaces, farmers encourage the growth of açaí through techniques described below. Farmers report "broadcasting" (in Portuguese *samear*) açaí seeds in the mature várzea forest to increase stand density. Farmers also thin naturally occurring stands, removing stems from multi-stemmed plants. This technique increases fruit productivity per individual palm. Forests managed for açaí and other economic species may be lightly managed and thus remain diverse. However when these areas are more intensively managed (often the goal of farmers today), they are converted into monospecific stands though the process of removing other trees,

shrubs, and vines that compete for light and other resources.[48] Finally, native açaí stands are also important sources of germplasm for farmers. Farmers often remove açaí seedlings from the forests to plant in the quintal or newly established açaízais. When transplanting an individual, farmers explain that the meristem of the plant (*o olho*) must be closed (not spreading) for the plant to become established in a new area.

Agrobiodiversity: Results of Plant Surveys in Annual Crop Fields

Field in Mutuacá

As discussed in the previous section, agricultural fields have almost disappeared in Mutuacá. On the 12 properties surveyed in Mutuacá, just four roçados were identified. All fields were monocultures of corn, ranging in size from 0.12 ha to 0.5 ha, with a plant density of 0.30/m or 3000/ha; in addition to corn, these areas had also previously been planted with white bean; *feijão branco* (*Phaseolus vulgaris*) harvested before the inventories were conducted.

Fields in Carvão

Despite community-wide shifts away from farming, a considerable number of families still plant an annual roça. Results of household economic surveys applied during 2005 and 2006 revealed that of 80 households, 44 maintained at least 0.2 ha in annual crops. The results also indicate that of these 44 families, 39 maintained monocultures of manioc. Nine of these manioc-producing families also had a small field of 0.2 ha in corn and

[48] Brondizio (1996) found the following differences between managed and unmanaged tidal várzea forests: In unmanaged forest, açaí contributes 15% of total basal area and represents less than 20% of the individuals and in intensively managed forests, açaí represents 50% of the total biomass and up to 90% of the total number of individuals.

beans; four additional families maintained an area of annual cropping in the várzea, with polycultures of corn, sugarcane, and banana.

In 2007, I returned to Carvão and surveyed 14 annual crop fields, all of which were planted either in December of 2006 or January or February of 2007. Of the 14 fields, 10 were found to be monocultures of manioc, and four were mixed annual fields dominated by manioc (Table 3.1). The average field size was 0.5 ha in size; the fields ranged from 0.1 to 1.4 ha. The density of crops in the field was 2.2/m. Plant surveys revealed that roças are characterized by low species richness; the richest field had four different crops, pineapple (*abacaxi*; *Ananas comosus*), manioc (*mandioca*; *Manihot esculenta*), corn (*milho*; *Zea Mays*), squash (*Cucurbita* sp.), and *cará do indio* (*Dioscorea trifida*). However, manioc varietal diversity was relatively high. In 14 different manioc fields, I identified 14[49] different manioc varieties[50] with the assistance of farmers (Table 3.3). On average, farmers maintained three manioc varieties in their fields, with a range of two to five varieties. In their fields, farmers either mixed all the different manioc varieties throughout or planted the field in small patches, designating one area for each manioc variety. Data on manioc varieties suggest that diversity is distributed evenly throughout the community, or in other words, a single farmer's field does not account for

[49] In addition to the 14 varieties found in farmers' fields, farmers also said that in the past they planted varieties known as, *Mulatinha*, *Piru*, *Inajá*, and *Castanha do Pará*. In 2005, I also came across a variety called *Jurará*, which farmers had acquired from RURAP agricultural extension agents. Technicians asked the farmers to experiment with planting the variety, as in field tests it produced large roots; however, in 2007, farmers reported that the plant never developed well in their fields.

[50] In this case, a manioc "variety" is defined as the unit identified by farmers on the basis of specific morphological and agronomic characteristics. This definition is different from the botanical definition of a cultivar—defined as a cultivated plant that has been selected and given a unique name on the basis of desirable characteristics that distinguish it from similar plants of the same species, and that are retained through either sexual or asexual reproduction (Brickell et al. 2004).

a large percentage of the variation recorded in the sample area. Just one variety of corn, squash and two varieties of pineapple were recorded.

Manioc varietal diversity

Farmers in Carvão distinguished between the 14 manioc varieties based on differences in plant stature, stem color, leaf-shape (and number of lobes), root pulp parenchyma color, the color and nature (if it is pubescent or glabrous) of new leaf shoots (meristems), and by agronomic qualities, such as the durability of the root, and its water content, which is also a measure of the varieties' ability to withstand periods of drought. Based on farmers' descriptions and in-field measurements (on 15 plants per variety) and observations from collected plant material, the 14 varieties can first be broken down into three groups on the basis of plant height: the short, "normal" and tall varieties, with just one tall and short variety (Table 3.3; refer to Appendix 3.1 for a botanical description of *Manihot esculenta* Cranz). *Semintinha* is a short manioc variety whose stem branches early (at less than a meter up the stem). Farmers describe the plant as "stout." Field measurements yielded a range in height from 1 to 1.2 meters. *Farião* is the tall variety, averaging from 2.5 to three meters in height. On average, the leaves of Farião are larger and the stem of this variety is thicker. Leaf color ranged from light-green to dark green with a range in size of 9 to 30 cm in length by 6 to 40 cm in width. Farião and the variety *Tataruga* can be recognized by their comparably larger leaves. The number of lobes also varied within the sample from three to seven lobes. Most plants had seven lobes; the varieties *Bouy* and *Pai Lourença* were exceptions with three and five lobes respectively. The petioles were also found to vary—ranging in length from 10 to 45 cm in length; both Farião and Tataruga had noticeably longer petioles (from 33-45 cm and 25-32cm respectively). Petiole color

ranged from light-red, to red, maroon or purplish black. Finally, root color varied from cream to light-yellow, yellow, white and grey.

A number of distinguishing agronomic characters was also recorded (Table 3.3). Farias was most commonly indicated as the farmers' variety of preference. Farias plants reportedly yield many larger storage roots per individual, and of all of the varieties it is the most durable—living in the soil for up to two years. In addition, farmers reported that *Tataruga* is valuable in the field among more durable varieties because it develops quickly in the soil (within eight months). Farião is valued because it produces thick roots; however, farmers report that it must be harvested more quickly than the other varieties because after a year, a secondary xylem (wood) begins to grow through the parenchyma of the storage roots. Farmers reported that they plant Semintinha for the purposes of producing tapioca, tapoquinha and farinha de tapioca; as compared to the other varieties, the roots of Semintinha contain more water, and thus facilitate the production process of these three products.[51] With the exception of Pai Lourença all of the varieties cultivated in Carvão have yellow to pale yellow pulp and thus yield "good-looking" farinha—adequate for sale in urban markets. (Urban consumers prefer to buy farinha that is white to pale yellow in color).

[51] See Cereda and Vilpoux (2003) <http://www.md.utfpr.edu.br/Intranet/professores/adm/download/apostilas/171959.pdf> for a description of this process, for which the easy removal of water is essential.

Table 3.3. Morphological and agronomic characters of farmer-named manioc varieties in Carvão, Brazil.

Farmer-named manioc varieties	Morphological description	Distinctive Agronomic characters
Bouy	Plant: 2 m; Stem: dark green; Petiole, bright red; 9-12 cm long; Leaf blade: 3-lobed, light green, 6-8 cm long x 19-12cm wide; Root pulp: yellow.	Farinha variety
Buritĺ	Plant: 2 m; Stem: light grey, tan; Petiole, light red; 22-28 cm long; Leaf blade: 7-lobed, light green, 16-18 cm long x 19-23 cm wide; Root pulp: light yellow.	Farinha variety
Farião -The tall, large, rooted variety	Plant: 2.5-3.5 m; Stem: light grey, tan; Petiole, deep red; 33-45 cm long; Leaf blade: 7-lobed; dark green, 23-30 cm long x 29-40 cm wide; Root pulp: yellow.	After 1 year, wood grows through edible portion of root (parenchyma tissues)
Farias amarela; farias -The variety that yields the "prettiest" farinha; preferred commercial variety	Plant: 2 m; Stem: light grey, tan; Petiole, red/transparent toward nodes; with green striations; 17-30 cm long; Leaf blade: 7-lobed; dark green, 15-25 cm long x 25-28 cm wide; Root pulp: light yellow	Edible roots have long durability (up to two years); high root to plant ratio; roots yield large quantities of farinha.
Farias ipixuna -The lighter version of Farias amarela	Plant: 2 m; Stem: light grey, tan; Petiole, light red with green striations; 22-30 cm long; Leaf blade: 7-lobed; dark green, 23-30 cm long x 29-40 cm wide; Root pulp: white.	Farinha variety
Pai Lourença -The dry rooted variety	Plant: 2 m; Stem: light grey, tan; Petiole, light red to maroon; 10-19 cm long; Leaf blade: 5-lobed, dark green, 14-17 cm long x 20-26cm wide; Root pulp: light yellow to grey.	Farinha variety; root contains less water content; dries out in period of drought.
Pescado	Plant: 2 m; Stem: light grey, tan; Petiole, light red; 17-20 cm long; Leaf blade: 7-lobed, dark green, 15-17 cm long x 25-28cm wide; Root pulp: white.	Farinha variety
Preúa	Plant: 2 m; Stem: light grey, tan; Petiole, light red; 17-20 cm long; Leaf blade: 7-lobed, lobes thin/fine, light green, 11-15 cm long x 15-18cm wide; Root pulp: yellow.	Farinha variety
Semintinha -Short, stout, tapioca-giving variety	Plant: 1-1.2 m: Stem: light grey, tan; Petiole, red at nodes, green throughout; 19-22 cm long; Leaf blade: 7-lobed, light green, 14-17 cm long x 20-26cm wide; Root pulp: cream-colored.	Tapioca variety: The roots have a high water content and therefore withstands period of drought; variety grown for tapioca and tucupi production.
Soín -The short, thin-leaved variety	Plant: 1-1.2 m; Stem: light grey, tan; Petiole, light red; 15-24 cm long; Leaf blade: 7-lobed; lobes thin/fine; dark green, 16-18 cm long x 19-23 cm wide; Root pulp: white.	Farinha variety
Tataruga -The robust, quick-growing variety	Plant: 2 m; Stem: light grey, tan; Petiole, light red; 25-32 cm long; Leaf blade: 7-lobed, green, 23-30 cm long x 26-30 cm wide; Root pulp: light yellow.	Farinha; the roots of this variety develop quickly; within 8 months the
Macaxiera preta -The dark, sweet variety	Plant: 2 m; Stem: dark grey; Petiole, dark purple; 14-18 cm long; Leaf blade: 7-lobed, green, 13-15 cm long x 11-15 cm wide; Root external color: reddish/purple; Pulp: white.	Macaxiera (sweet manioc variety) edible root boiled and consumed.
Macaxiera manteiga -The sweet variety of the várzea	Plant: 2 m; Stem: light grey, tan; Petiole, light green with faint pink striations; 15-17 cm long; Leaf blade: 7-lobed, green, 12-14 cm long x 15-19 cm wide; Root pulp: white.	Macaxiera (sweet manioc variety); edible root boiled and consumed; capable of growing in water-logged várzea soils.
Macaxiera branca	Plant: 2 m; Stem: light grey; Petiole, dark red; 21-29 cm long; Leaf blade: 7-lobed, green, 23-25 cm long x 25-27 cm wide; Root pulp: white.	Macaxiera (sweet manioc variety) edible root boiled.

Agrobiodiversity of home gardens, Carvão

Compared to fields, home gardens in both communities are characterized by high levels of plant diversity. Eighteen home gardens were measured and inventoried in Carvão. The average size of the garden was calculated at 0.23 ha, with a range of 0.05 to 0.9 ha (Table 3.4). Within these small areas, a number of field types were encountered, including herb gardens and vegetable gardens, and fruit orchards. Within the 18 inventoried home gardens in Carvão, covering an area of 4.1 ha, a total of 116 cultivated (or protected) species were recorded. The average number of species was 33 per home garden with a range of 19 to 57 species per garden (Figure 3.4). The total density of individuals/ha was calculated at 737/ha; the total number of species/ha was 29. A Shannon index of 3.63 was calculated for species and the β-diversity values calculated at 2.5. The names of all plant species encountered are found on Table 3.5 for both sample areas.

In addition to species richness, there was a high degree of intra-specific diversity for some species. Six farmer-named varieties of bananas were recorded (Table 3.6). Farmers distinguish banana varieties by differences in the plants' stature, the coloration of the petioles, leaf shape, and by differences in fruit characteristics, including size, shape, consistency and sweetness. In addition, two different sweet manioc were identified (*macaxiera branca* and *macaxeira preta*). Finally, two passion fruit varieties, two lemon varieties, four orange varieties, and at least four different types of mangos are planted in Carvão.

The 109 indentified species belong to 43 different families (Table 3.5, Table 3.7). The best represented families are Lamiaceae with ten species followed by Arecaceae,

Euphorbiaceae, and Rutaceae, all with eight species (Table 3.5). Of the 116 species recorded, 52 are herbs and seven are palms, 36 are trees, 15 are shrubs, and six are vines (Table 3.5). Plants in the sample had many uses, including fruit, medicine, vegetables, root crops, seasonings, timber, latex, stimulants, insecticides and fish poisons. Plants were most commonly cultivated for medicinal purposes and for consumption as fruit (Figure 3.5). Results of correlation analysis show that the size of the garden (in ha) was moderately correlated with species richness ($R^2 = 0.49$). A similar result was found for the number of individuals versus plant species richness ($R^2 = 0.5$).

Agrobiodiversity in home gardens, Mutuacá

A total of 14 home gardens covering an area of 3.5 ha were inventoried in Mutuacá.[52] The average size of the quintal was calculated at 0.25 ha, with a range of 0.06 ha to 0.8 ha (Table 3.4). In these 14 gardens, a total of 90 species was recorded. The average number of species per home garden was 32 species with a range of 9 to 41 species in the sample area (Figure 3.5). The total density of individual/ha was calculated at 1133; the total number of species/ha was 26. The Shannon index of 2.2 was calculated for the sample area; β- diversity was calculated at 2.9. Similar to Carvão, a considerable amount of intra-specific diversity was observed in select species. Nine farmer-named varieties of bananas were recorded (Table 3.6). In addition, three different common pepper varieties are grown in the area, along with two passion fruit varieties and two lemon varieties (Table 3.5).

[52] In all cases, property owners helped identify the area pertaining to the quintal. Given the conversion of land to açaízal, the dividing lines between land use types are increasingly blurred.

The 86 species (for which identifications to a family level were made) belong to 39 different families (Table 3.5, Table 3.7). The best represented families included: Lamiaceae with ten different species, Arecaceae with seven species, Asteraceae with six species, and Myrtaceae with five species (Table 3.5). Of the 86 identified species, 38 are herbs, 35 are trees, seven are shrubs, six are palms, and four are vines (Table 3.5). As in Carvão, uses of plants varied considerably; plants are consumed as fruits and vegetables, used for timber and construction, as seasoning, stimulant beverages, insecticides, and fish poisons. The most commonly reported plant use was for consumption as a fruit, followed by medicine (Figure 3.5). As in Carvão, both the area and number of individuals show a moderate relationship between the two parameters (R^2 =0.57 and R^2=0.65 respectively).

Figure 3.4. Box-plots comparing median number of plant species recorded in home gardens in Carvão and Mutuacá, Brazil.

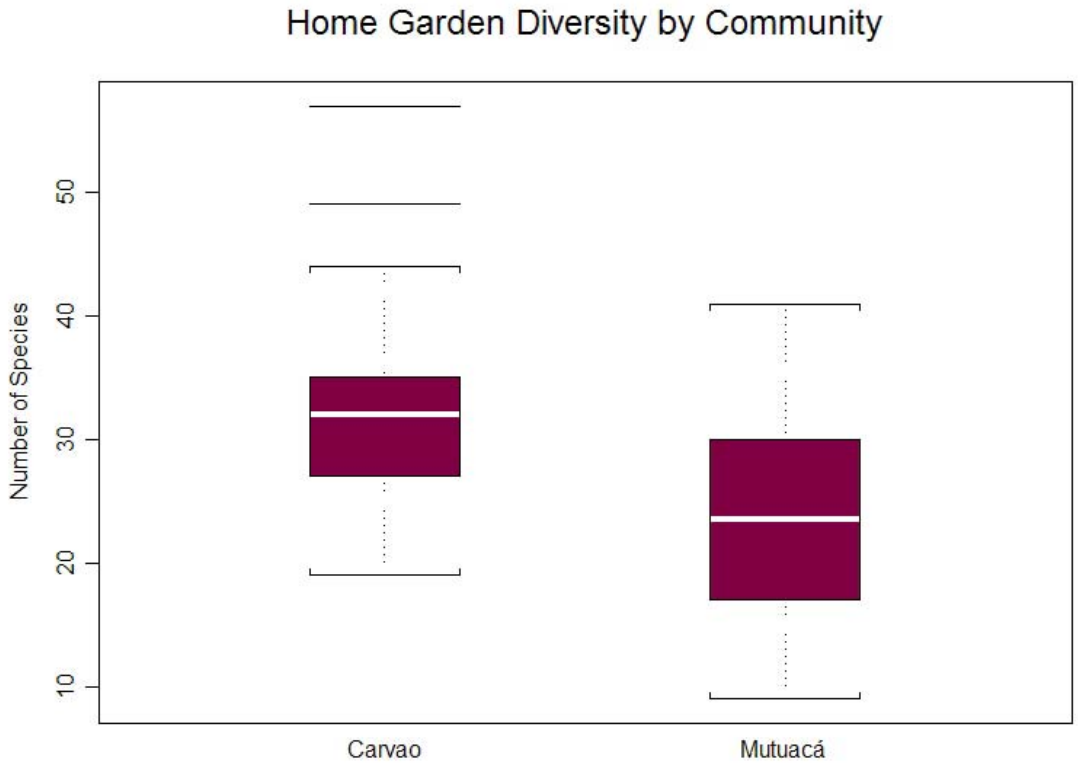

Figure 3.5. Primary uses of plants identified in home gardens in Carvão and Mutuacá, Brazil out of 132 identified species.

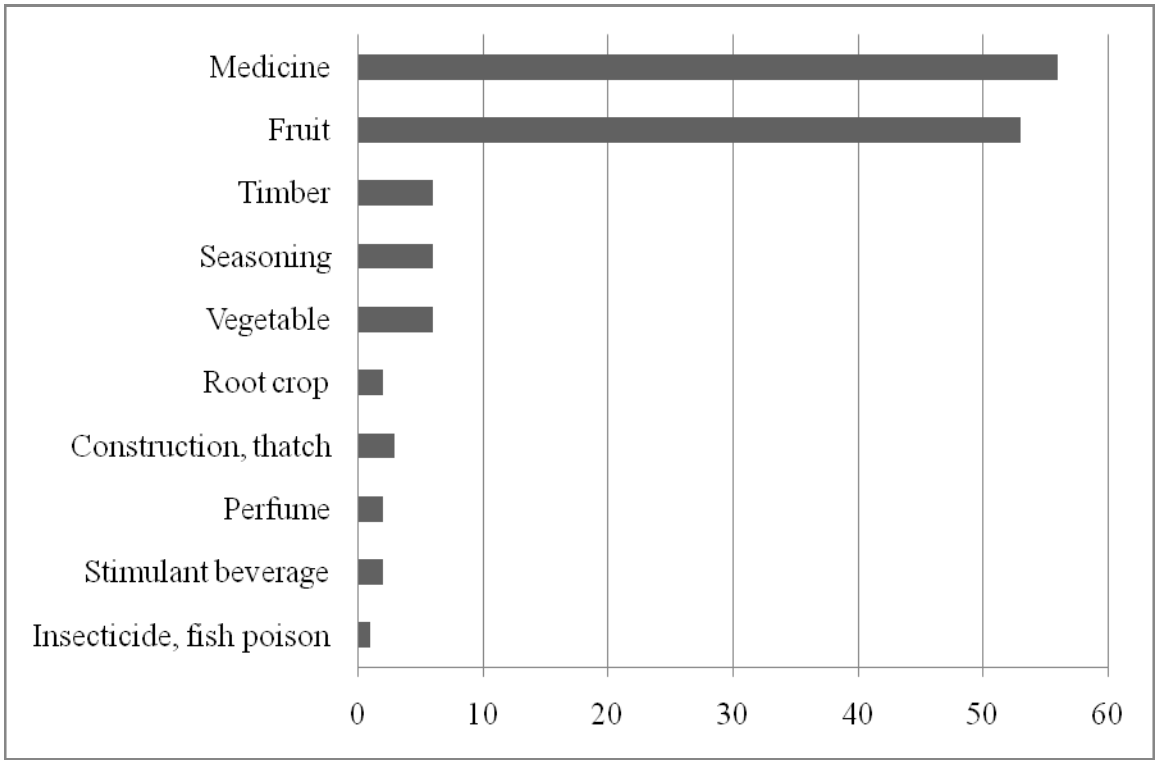

Table 3.4. Summary of results obtained in home garden vegetation analyses in Carvão and Mutuacá, Brazil and comparison of findings with studies in naturally occurring terra firme and estuarine várzea forests of Amazonia.

	Carvão, terra firme home gardens (source, this study)	**Mutuacá, várzea home gardens (source, this study)**	**Low várzea forest, eastern Amazon, Guamá River, Brazil (Cattanio et al. 2002)**	**Terra firme forest, Brazil/Venezuela border (Neblina base camp), upper Amazon (Gentry, A. 1987)**
Total area (ha) sampled	4.12	3.5	0.2	1
Mean area (ha)	0.23 *Range 0.05-0.9*	0.25 *Range 0.06-0.8*	-	-
Mean no. of species/garden (plot)	33 *Range = 19-57 sp.*	23 *Range = 9-41 sp.*	-	-
Total no. of species/sample area (Richness)	116	90	67 (with a min. dbh of 5 cm)	107
No. of species/ha	29	26	335	107
Total density (ind./ha)	737	1133	1190	513
Shannon diversity index (Sample area)	3.63	2.2	-	-
β-Diversity	2.5	2.9		

Table 3.5. List of economic plants cultivated in home gardens in Carvão and Mutuacá, Brazil.

*Refers to the number of gardens in which the plant occurs in C-Carvão and M-Mutuacá

Family	Common name	Scientific Name	*#C	#M	Habit
Alliacaeae	*Cebola*	*Allium cepa* L.	6	8	H
Aloeaceae	*Aloe*	*Aloe vera* Mill.	4	0	H
Anacardiaceae	*Caju*	*Anacardium occidentale* L.	16	10	T
Anacardiaceae	*Manga*	*Mangifera indica* L.	18	10	T
Anacardiaceae	*Taperebá*	*Spondias mombin* L.	2	13	T
Annonaceace	*Biribá*	*Annona mucosa* Jacq.	8	4	T
Annonaceae	*Graviola*	*Annona muricata* L.	16	6	T
Annonaceae	*Conde*	*Annona reticulata Sieber* ex A.DC.	1	0	H
Apiacaeae	*Chicoria*	*Eryngium foetidum* L.	3	2	H
Apiacaeae	*Cominho*	*Cuminum cyminum* L.	1	2	H
Apocynaceae	*Sicuriju, Sucuba*	*Himatanthus sucuuba* (Spruce) Woodson	1	0	T
Araceae	*Taja, Tajoba*	Indet.	2	1	H
Arecaceae	*Açaí*	*Euterpe oleracea* Mart.	11	15	P
Arecaceae	*Bacaba*	*Oenocarpus bacaba* Mart.	10	2	P
Arecaceae	*Bussú*	*Manicaria saccifera* Gaertn.	0	1	P
Arecaceae	*Côco*	*Cocos nucifera* L.	12	1	V
Arecaceae	*Inajá*	*Attalea maripa Mart.*	2	0	P
Arecaceae	*Mucajá*	*Acrocomia aculeata* Lodd. ex Mart.	10	1	P
Arecaceae	*Pupunha*	*Bactris gasipaes* Kunth	15	6	P
Arecaceae	*Tucumã*	*Astroçaryum vulgare* Mart.	4	0	P
Arecaceae	*Urucuri*	*Attalea excelsa* Mart.	0	1	P
Asteraceae	*Anador*	*Artemisia verlotiorum Lamotte*	5	1	H
Asteraceae	*Boldo*	*Veronica condensata* Hort. ex Rchb.	1	2	H
Asteraceae	*Catinga de mulata*	*Tanacetum vulgare* L.	3	4	H
Asteraceae	*Cravo*	*Tagetes erecta* L.	1	6	H
Asteraceae	*Mastruz*	*Chenopodium ambrosioides* L.	1	2	H
Asteraceae	*Picão*	*Bidens* sp. L.	0	1	H
Bignoniaceae	*Cuia*	*Crescentia cujete* L.	5	2	T
Bignoniaceae	*Marupa*	*Jacaranda copaia* D.Don	1	0	S
Bignoniaceae	*Pariri, Barrii*	*Arrabidaea chica* (Humb. & Bonpl.) Verl.	9	4	H
Bignoniaceae	*Cipó alho*	*Adenocalymma alliaceum* Miers	1	0	V
Bixaceae	*Urucum*	*Bixa orellana* L.	12	8	H
Brassicaceae	*Couve*	*Brassica oleracea* L.	2	0	H
Brassicaceae	*Couve manteiga*	*Brassica* sp. L.	1	1	H
Bromeliaceae	*Abacaxi*	*Ananas comosus* (L.) Merr.	9	1	H
Caprifoliaceae	*Sabugueira*	*Sambucus nigra* L.	2	2	S
Caricaceae	*Mamao*	*Carica papaya* L.	10	10	S

Caryocaraceae	*Piquiá*	*Caryocar villosum* Pers.	2	0	T
Crasssulaceae	*Cai grelha*	*Bryophyllum calycinum* Salisb.	4	0	H
Cucurbitaceae	*Jerimú*	*Cucurbita* sp. L.	4	1	H
Cyperaceae	*Pripioca*	*Cyperus* sp. L.	1	0	H
Cyperaceae	*Priprioca grande*	*Cyperus* sp. L.	1	0	H
Discoreaceae	*Cará do índio*	*Dioscorea trifida* L.f.	6	0	V
Euphorbiacaeae	*Sacaca*	*Croton cajucara* Benth.	2	0	S
Euphorbiacaeae	*Seringa*	*Hevea brasiliensis* (Willd. ex A.Juss.) Müll.Arg.	2	4	T
Euphorbiaceae	*Macacheira*	*Manihot esculenta* Cranz	2	0	S
Euphorbiaceae	*Peão branco*	*Jatropha curcas* L.	8	4	S
Euphorbiaceae	*Peão roxo*	*Jatropha gossyfiifolia* L.	8	8	S
Fabaceae	*Macacaúba*	*Platymiscium ulei* Harms	0	2	T
Fabaceae	*Marimari*	*Cassia leinadra* Benth	1	4	T
Fabaceae	*Timbó*	*Lonchocarpus urucum* L.	2	0	V
Heliconiaceae	*Canafish*	Indet.	5	0	H
Indet.	*Brasileira*	Indet.	2	1	H
Indet.	*Busca pau*	Indet.	0	2	V
Indet.	*Caramba*	Indet.	1	1	T
Indet.	*Cibalena*	Indet.	1	0	H
Indet.	*Insulina*	Indet.	1	0	H
Indet.	*Jambre*	Indet.	8	4	H
Indet.	*Jericão*	Indet.	1	0	H
Indet.	*Juru*	Indet.	2	2	V
Indet.	*Majerona da angola*	Indet.	2	0	H
Indet.	*Salsa*	Indet.	1	0	H
Indet.	*Siquiuba*	Indet.	2	0	T
Lamiaceae	*Majericão*	*Ocimum basilicum* L.	5	0	H
Lamiaceae	*Hortela grande*	*Mentha viridis* L.	4	3	H
Lamiaceae	*Hortelao pequeno*	*Mentha piperita* L.	2	2	H
Lamiaceae	*Majerona da panela*	*Majorana hortensis* Moench	0	1	H
Lamiaceae	*Malvarisco*	*Coleus amboinicus* Lour.	0	1	H
Lamiaceae	*Melhorao de planta*	*Coleus barbatus* L.	1	0	H
Lamiaceae	*Oriza*	*Pogostemon heyneanus* Benth.	1	1	H
Lamiaceae	*Patchuli*	*Pogostemon patchouly* Pellet.	4	1	H
Lamiaceae	*Pau de angola*	*Vitex* sp. L.	0	1	H
Lamiaceae	*Trevo*	Indet.	0	1	H
Lamiaceae	*Trevo grande*	Indet.	0	1	H
Lamiaceae	*Trevo roxo*	*Scutellaria agrestis* St. Hill. Ex. Benth.	0	1	H
Lauraceae	*Abacate*	*Persea americana* Mill.	16	0	T
Lauraceae	*Canela*	*Cinnamomum zeylanicum* Blume	4	1	T
Lauraceae	*Itaúba*	*Mezilaurus itauba* (Meisn.) Taub. ex Mez.	1	0	T
Lecythidaceae	*Castanha do Pará*	*Bertholletia excelsa* Humb. & Bonpl.	5	0	T

Lecythidaceae	*Ceru*	*Allantoma lineata* Miers.	1	0	S
Lecythidaceae	*Sapucaia*	*Lecythis pisonis* Camb.	3	1	T
Malpighiaceae	*Acerola*	*Malpighia emarginata* ex DC.	14	2	S
Malpighiaceae	*Murici*	*Byrsonima crassifolia* Steud.	5	1	T
Malvaceae	*Algodão*	*Gossypium barbadense L.*	8	1	H
Malvaceae	*Vinagreira*	*Hibiscus sabdariffa* L.	7	1	H
Meliaceae	*Andiroba*	*Carapa guianensis* Aubl.	5	3	T
Mimoaceae	*Ingá amarela*	*Inga* sp. Mill.	1	1	T
Mimoaceae	*Ingá cabeluda*	*Inga* sp. Mill.	1	0	T
Mimoaceae	*Ingá cipó do metro*	*Inga edulis* Mart.	12	11	T
Mimoaceae	*Ingá pracauba*	*Inga* sp. Mill.	1	0	T
Moraceae	*Fruto pau, Jaca*	*Artocarpus altilis* (Parkinson) Fosberg	0	2	T
Musaceae	*Banana (various varieties)*	*Musa acuminata* Colla	2	0	H
Myristicaceae	*Virola*	*Virola sp.* Aubl.	0	4	T
Myrtaceae	*Ameixa*	*Eugenia cumini* (L.) Druce	4	2	T
Myrtaceae	*Azeitona brava*	*Eugenia* sp. L.	0	1	T
Myrtaceae	*Camu camu*	*Myrciaria dubia* (Kunth) McVaugh	1	0	S
Myrtaceae	*Goaiba*	*Psidium guajava* L.	17	13	T
Myrtaceae	*Jaboticaba*	*Myrciaria* sp. O. Berg.	1	0	S
Myrtaceae	*Jaca da bahia*	*Syzygium malaccense* (L.) Merr. & L.M. Perry	9	5	T
Oxalidaceae	*Carambola*	*Averrhoa carambola* L.	2	0	T
Oxalidaceae	*Limão de cayena*	*Averrhoa bilimbi* L.	5	1	T
Passifloraceae	*Maracuja comum*	*Passiflora* sp. L.	3	1	V
Piperaceae	*Oleo electrico*	*Piper callosum* Opiz	1	0	H
Poaceae	*Cana*	*Saccharum* sp.	4	3	H
Poaceae	*Capim marim*	*Cymbopogon citratus* Stapf.	4	3	H
Polygonaceae	*Eucalipto*	Indet.	2	1	H
Portulacaceae	*Amor crecido*	*Portulaca pilosa* L.	5	1	H
Portulacaceae	*Cariru*	*Talinum fruticosum* (L.) Jess.	5	0	H
Rubiaceae	*Café*	*Coffea arabica* L.	6	1	S
Rubiaceae	*Genipapo*	*Genipa americana* L.	2	3	T
Rubiaceae	*Pau mulato*	*Calycophyllum spruceanum* Benth.	0	11	T
Rubiaceae	*Viqui*	*Faramea corymbosa* Aublet	1	0	H
Rutaceae	*Aruda*	*Ruta graveolens* L.	3	0	H
Rutaceae	*Laranja*	*Citrus sinensis* (L.) Osbeck	14	7	T
Rutaceae	*Laranja (tira gosta)*	*Citrus* sp. L.	3	0	T
Rutaceae	*Laranja pera*	*Citrus* sp. L.	2	0	T
Rutaceae	*Lima*	*Citrus aurantifolia* Swingle	1	3	T
Rutaceae	*Limão*	*Citrus limon* (L.) Burm. F.	16	12	T
Rutaceae	*Tangerina*	*Citrus reticulate* Blanco	4	3	T
Sapindaceae	*Pitomba*	*Talisia esculenta* Radlk.	1	2	T

Sapotaceae	*Abiu*	*Pouteria caimito* Radlk.	8	1	T
Sapotaceae	*Cutite*	*Pouteria macrophylla* (Lam.) Eyma.	2	2	T
Sapotaceae	*Sapotilla*	*Manilkara zapota* (L.) P. Royen	3	0	T
Solanaceae	*Janjilí*	Indet.	5	0	H
Solanaceae	*Pimenta comun*	*Capsicum* sp. L.	12	4	H
Solanaceae	*Tomate*	*Lycopersicon esculentum* Mill.	1	2	H
Sterculiaceae	*Cacau*	*Theobroma cacao* L.	2	2	T
Sterculiaceae	*Cacau jacaré*	*Theobroma mariae* Schum.	1	1	T
Sterculiaceae	*Cupuaçu*	*Theobroma grandiflorum* Schum.	18	11	T
Verbenaceae	*Erva cidreira*	*Lippia alba* (Will.) NE Br.	5	1	H
Verbenaceae	*Fo sange*	Indet.	6	0	H
Zingiberaceae	*Gengibre*	*Zingiber officinale* Roscoe	6	1	H

Table 3.6. Intra-specific Banana (*Musa* sp.) diversity in Carvão and Mutuacá, Brazil.
*M = Mutuacá and C = Carvão

Farmer-named variety	Communities	Distinguishing traits (as told by farmers)
Banana Bailique	M, C	Tall variety, up to 3 m; with long, dry fruit (boiled or fried like a potato)
Banana Baixa	M, C	Stout plant, growing to 2 m
Banana Chertada	C	Indet.
Banana Filipina	M	Transported from Peru; large tree up to 3 m
Banana Inajá	M	Tall plant, up to 3 m; fruits stout; leaves lanceolate
Banana Prata	M, C	Commercial variety; tall up to 3 m; leaves long, lanceolate
Banana Roxa	M, C	Leaf venation, petioles, and peel reddish purple
Banana "São Tome"	M	Tall plant, up to 3 m; fruit dwarfed; peel green
Banana Sul	M, C	Ident.
Banana Urocuri	M	Similar to Inajá but even larger in stature

Importance values of woody species in home gardens, Carvão

A total of 45 woody species (trees and shrubs with a DBH of <2.5 cm) were recorded in home gardens in Carvão, and a total basal area of 19.6 m^2/ha was calculated from this sample; the stand density was calculated at 229 individuals/ha (Table 3.8). Woody species in Carvão belong to 18 families[53] with Fabaceae *sensu lato*, Rutaceae and Sapotaceae being the best represented, with five and four and four species respectively (Table 3.7). The most important species on the basis of relative density, relative dominance, and relative frequency were *Mangifera indica*, *Caryocar villosum*, *Spondias mombin*, *Citrus sinensis*, *Anacardium occidentale*, and *Theobroma grandiflorum*; both *C. villosum* and *S. mombin* were represented by just one individual. The low relative density

[53] Three species were not identified to the family level and thus excluded from this analysis.

and relative frequency values were compensated by high relative dominance (basal area), as compared to the other species in the group. The high dominance is attributed to their status as trees conserved from the terra firme forest that once existed in the place of the current village.

Table 3.7. Distribution of woody plant families in home gardens in Carvão and Mutuacá, Brazil.

Carvão		***Mutuacá***	
Plant Family	**No. of species**	**Plant Family**	**No. of species**
Fabaceae	5	Rutaceae	4
Rutaceae	4	Fabaceae	3
Sapotaceae	4	Myrtaceae	3
Annonaceae	3	Anacardiaceae	3
Euphorbiaceae	3	Annonaceae	2
Lauraceae	3	Euphorbiaceae	2
Myrtaceae	3	Rubiaceae	2
Anacardiaceae	3	Sapotaceae	2
Lecythidaceae	2	Sterculiaceae	2
Rubiaceae	2	Bignoniaceae	1
Sterculiaceae	2	Bixaceae	1
Bignoniaceae	1	Lauraceae	1
Bixaceae	1	Malpighiaceae	1
Caryocaraceae	1	Meliaceae	1
Malpighiaceae	1	Moraceae	1
Malvaceae	1	Myristicaceae	1
Meliaceae	1	Oxalidaceae	1
Oxalidaceae	1		
Sapindaceae	1		

Table 3.8. Phytosociological parameters obtained in 4.12 ha sample of woody species <2.5cm DBH (excluding palms) in home gardens of Carvão, Brazil.

Scientific name	NI*	NQ	BA (m^2/ha)	R. Dens	RF	RD	IV
1. *Mangifera indica*	133	17	0.4908	0.1415	0.0664	0.0249	0.0776
2. *Caryocar villosum*	1	1	4.1193	0.0011	0.0039	0.2094	0.0714
3. *Spondias mombin*	2	2	3.8463	0.0021	0.0078	0.1955	0.0685
4. *Citrus sinensis*	122	15	0.0905	0.1298	0.0586	0.0046	0.0643
5. *Anacardium occidentale*	109	15	0.3545	0.1160	0.0586	0.0180	0.0642
6. *Theobroma grandiflorum*	118	13	0.0570	0.1255	0.0508	0.0029	0.0597
7. *Psidium guajava*	72	17	0.0926	0.0766	0.0664	0.0047	0.0492
8. *Annona muricata*	73	15	0.1319	0.0777	0.0586	0.0067	0.0477
9. *Persea americana*	30	14	0.3340	0.0319	0.0547	0.0170	0.0345
10. *Citrus limon*	38	15	0.0771	0.0404	0.0586	0.0039	0.0343
11. *Inga edulis*	28	13	0.2085	0.0298	0.0508	0.0106	0.0304
12. *Malpighia emarginata*	35	11	0.0433	0.0372	0.0430	0.0022	0.0275
13. *Bertholletia excelsa*	6	4	1.1232	0.0064	0.0156	0.0571	0.0264
14. *Syzygium malaccense*	10	9	0.5560	0.0106	0.0352	0.0283	0.0247
15. *Mezilaurus itauba*	1	1	1.2368	0.0011	0.0039	0.0629	0.0226
16. *Bixa orellana*	20	10	0.0556	0.0213	0.0391	0.0028	0.0211
17. *Talisia esculenta*	1	1	1.1162	0.0011	0.0039	0.0567	0.0206
18. *Carapa guianensis*	1	2	1.0298	0.0011	0.0078	0.0523	0.0204
19. *Byrsonima crassifolia*	27	6	0.1526	0.0287	0.0234	0.0078	0.0200
20. *Annona mucosa*	13	8	0.1648	0.0138	0.0313	0.0084	0.0178
21. *Pouteria macrophylla*	4	2	0.8028	0.0043	0.0078	0.0408	0.0176
22. Indet. *("Jambre")*	9	7	0.2855	0.0096	0.0273	0.0145	0.0171
23. *Jatropha curcas L.*	9	8	0.1303	0.0096	0.0313	0.0066	0.0158
24. *Pouteria caimito*	8	6	0.0634	0.0085	0.0234	0.0032	0.0117
25. Indet. *("Carumba")*	3	4	0.3039	0.0032	0.0156	0.0154	0.0114
26. *Eugenia cumini*	8	4	0.1547	0.0085	0.0156	0.0079	0.0107
27. *Citrus reticulata*	6	5	0.0595	0.0064	0.0195	0.0030	0.0096
28. *Crescentia cujete*	7	4	0.0780	0.0074	0.0156	0.0040	0.0090
29. Indet.							
30. *("Siquiuba")*	1	1	0.4269	0.0011	0.0039	0.0217	0.0089
31. *Averrhoa bilimbi*	4	5	0.0525	0.0043	0.0195	0.0027	0.0088
32. *Hevea brasiliensis*	3	2	0.3039	0.0032	0.0078	0.0154	0.0088
33. *Coffea arabica*	10	3	0.0347	0.0106	0.0117	0.0018	0.0080

34. *Inga sp.*	1	1	0.3741	0.0011	0.0039	0.0190	0.0080
35. *Lecythis pisonis*	3	1	0.2235	0.0032	0.0039	0.0114	0.0062
36. *Inga sp.*	1	1	0.2504	0.0011	0.0039	0.0127	0.0059
37. *Inga sp.*	1	1	0.2367	0.0011	0.0039	0.0120	0.0057
38. *Genipa americana*	2	2	0.1357	0.0021	0.0078	0.0069	0.0056
39. *Theobroma cacao*	5	2	0.0327	0.0053	0.0078	0.0017	0.0049
40. *Cinnamomum zeylanicum*	4	1	0.1159	0.0043	0.0039	0.0059	0.0047
41. *Manilkara zapota*	4	1	0.0886	0.0043	0.0039	0.0045	0.0042
42. *Gossypium barbadense*	2	2	0.0255	0.0021	0.0078	0.0013	0.0037
43. *Cassia leinadra*	1	1	0.0558	0.0011	0.0039	0.0028	0.0026
44. *Croton cajucara*	1	1	0.0558	0.0011	0.0039	0.0028	0.0026
45. *Citrus aurantifolia*	1	1	0.0435	0.0011	0.0039	0.0022	0.0024
46. *Annona reticulata*	1	1	0.0278	0.0011	0.0039	0.0014	0.0021

***** NI is number of individuals (density), NQ is the number of home gardens where species is present (frequency), BA, total basal area (dominance), R. Dens relative density), R. Dom (relative dominance) and IV in the importance value.

Importance value of woody species in home gardens, Mutuacá

A total of 33 woody species (trees and shrubs with a DBH of <2.5 cm) were recorded in home gardens in Mutuacá, and a total basal area of 25.077m^2/ha was calculated for this sample; the stand density was calculated at 110 individuals/ha (Table 3.9). Woody species belong to 17 families. The four families represented by most species are Rutaceae with four species, Fabaceae *sensu lato*, Myrtaceae and Anacardiaceae, each with three species (Table 3.7). The four most important species on the basis of relative density, relative dominance, and relative frequency were *Calycophyllum spruceanum, Psidium guajava*, *Spondias mombin*, *Theobroma gradiflorum, Calycophyllum spruceanum* was by far the most abundant, however the relative basal area for this species was lower than the value calculated for *Spondias mombin*. These differences in these phytosociological values are expected given that *C. spruceanum* is a fast-growing species that germinates in

areas that have previously been cleared in the process of shifting cultivation (Sears 2003, Pinedo-Vasquez et al. 2001). Thus, while *C. spruceanum* is numerous in the sample area, most individuals are relatively young in age. *Spondias mombin* on the other hand is a native tree of the várzea forest, which grows abundantly in the native forests. Farmers reportedly maintain only a few of these individuals, each of which produces a high abundance of fruits with a growing economic value in the region. *Psidum guajava* is also a small tree; however, its relatively small basal area is made up by its abundance.

Table 3.9. Phytosociological parameters obtained in 3.5 ha sample for woody species <2.5cm DBH (excluding palms) in home gardens of Mutuacá, Brazil.

Scientific name	NI	NQ	BA	R. Dens.	RF	RD	IV
1. Calycophyllum spruceanum	95	10	0.4794	0.2468	0.0840	0.0191	0.1166
2. Spondias mombim	42	10	1.7988	0.1091	0.0840	0.0717	0.0883
3. Psidium guajava	58	12	0.1990	0.1506	0.1008	0.0079	0.0865
4. Hevea brasiliensis	9	4	2.6279	0.0234	0.0336	0.1048	0.0539
5. Mangifera indica	26	6	0.8882	0.0675	0.0504	0.0354	0.0511
6. *Virola* sp.	8	5	2.2709	0.0208	0.0420	0.0906	0.0511
7. Theobroma grandiflorum	32	5	0.1382	0.0831	0.0420	0.0055	0.0435
8. Inga edulis	10	7	0.9016	0.0260	0.0588	0.0360	0.0403
9. Anacardium occidentale	10	8	0.5451	0.0260	0.0672	0.0217	0.0383
10. Artocarpus altilis	4	2	2.0591	0.0104	0.0168	0.0821	0.0364
11. Eugenia sp.	1	1	2.3111	0.0026	0.0084	0.0922	0.0344
12. Carapa guianensis	10	4	0.9325	0.0260	0.0336	0.0372	0.0323
13. Genipa americana	3	2	1.8001	0.0078	0.0168	0.0718	0.0321
14. Syzygium malaccense	4	4	1.1430	0.0104	0.0336	0.0456	0.0299
15. Citrus limon	5	4	0.6877	0.0130	0.0336	0.0274	0.0247
16. Annona muricata	17	3	0.1010	0.0442	0.0252	0.0040	0.0245
17. Bixa orellana	10	5	0.0998	0.0260	0.0420	0.0040	0.0240
18. Citrus sinensis	6	4	0.2813	0.0156	0.0336	0.0112	0.0201
19. Crescentia cujete	1	1	1.1659	0.0026	0.0084	0.0465	0.0192
20. Cassia leinadra	2	2	0.6597	0.0052	0.0168	0.0263	0.0161
21. Annona mucosa	3	3	0.3652	0.0078	0.0252	0.0146	0.0159
22. Citrus reticulata	3	3	0.3049	0.0078	0.0252	0.0122	0.0151
23. Theobroma cacao	9	1	0.3355	0.0234	0.0084	0.0134	0.0151
24. Pouteria caimito	3	1	0.5864	0.0078	0.0084	0.0234	0.0132
25. Pouteria macrophylla	2	2	0.4240	0.0052	0.0168	0.0169	0.0130
26. Indet.	2	2	0.2403	0.0052	0.0168	0.0096	0.0105
27. Indet.	1	1	0.4781	0.0026	0.0084	0.0191	0.0100
28. Platymiscium ulei	3	2	0.0781	0.0078	0.0168	0.0031	0.0092
29. Averrhoa bilimbi	2	1	0.3533	0.0052	0.0084	0.0141	0.0092
30. Citrus aurantifolia	1	1	0.3675	0.0026	0.0084	0.0147	0.0086
31. Cinnamomum zeylanicum	1	1	0.3230	0.0026	0.0084	0.0129	0.0080
32. Byrsonima crassifolia	1	1	0.0862	0.0026	0.0084	0.0034	0.0048
33. Jatropha curcas	1	1	0.0446	0.0026	0.0084	0.0018	0.0043

***** NI is number of individuals (density), NQ is the number of home gardens where species is present (frequency), BA, total basal area (dominance), R. Dens relative density), R. Dom (relative dominance) and IV in the importance value.

Farmers' Management Strategies: Home Gardens (*quintais*)

Maintaining the home garden

In contrast to results reported in other studies on home gardens in caboclo communities, home gardens in Carvão are maintained by both men and women—and are not strictly the domain of women (c.f. WinklerPrins 2002; 2005). On the other hand, specific spaces within the home garden are considered "female spaces." For instance, women are the sole caretakers of medicinal plant, herb, and vegetable gardens in both communities.[54] Home gardens in Carvão vary from highly groomed and managed spaces, to those that are more or less abandoned. The latter spaces have a higher incidence of spontaneously occurring plant species, including *manga*; mango (*Mangifera indica*) and *caju* (*Anacardium occidentale*). In Mutuacá, gardens are either well-developed or are in the process of being planted. Farmers, who are dedicated to managing these spaces, continuously weed during the summer months. In the rainy season weeds are allowed to grow and take over the garden. Like agricultural fields, gardens are weeded with machetes and hoes; however, unlike in fields, the weeds are removed and discarded.

Accounting for agrobiodiversity in home gardens: acquisition of plant materials

Interviews and observations revealed that seeds and seedling for cultivation in home gardens in both Carvão and Mutuacá are acquired in various ways. As one farmer told me during an interview, "the guy who likes to plant, fetches the materials he wants—from wherever he goes.[55] Interviews with farmers revealed that many residents inherit plants from previous garden owners. This occurs commonly in both communities, as families

[54] That women care for these plants is not remarkable, as women are also in charge of cooking and generally looking out for the health and well-being of their children and husbands.
[55] Sr. Antonio Lopes, Carvão.

commonly cycle through various houses and house-lots often within short periods of time. New planting materials, on the other hand, are most commonly obtained from extended kin and neighbors. In particular, medicinal plants in both communities are most often exchanged through these networks. One common medicinal plant in both communities, *parrií* (*Arrabidae chica*) valued for its use in combating anemia, can be traced back to an original colony of the same species maintained by a female farmer in the nearby community of Mazagão Velho who brought the plant back from Belém, Pará after visiting her daughter. Through observations, I also noted that fruits purchased in urban areas become important sources of planting materials. In addition, seed for herbs and vegetables, such as *Brassica oleracea* are often purchased in cities. While rural development and extension services in the region are generally regarded as poor (by all farmers whom I interviewed in both 2006 and 2007), RURAP and EMBRAPA occasionally supply farmers with seedlings (*mudas*) of commercial value to plant on their properties. Seedlings of the following species: *cupuaçu* (*Theobroma grandiflorum*), *graviola* (*Annona muricata*), *pupunha* (*Bactris gasipaes*), *bacabei*, a variety of *bacaba* (*Oenocarpus bacaba*), *acerola* (*Malpighia emarginata*), *castanha* (*Bertholletia excelsa*) and *caju* (*Anacardium occidentale*) are most commonly distributed by these agencies. Material given by these agencies is not evenly distributed in the study area. Extension agents favor Carvão farmers who are more accessible. In addition, seedlings are most often given to families who are politically connected or have relatives who work for the agencies.

The value of home gardens and their agrobiodiversity

Generally speaking Carvão and Mutuacá residents consider home gardens an extension of the home. In Carvão home gardens are valued as pleasant, shady spaces in the terra firme, which for much of the year is characterized by a harsh, hot and dry climate. In Carvão, home gardens are the site of family gatherings and places to receive visitors. In Mutuacá, because várzea soils remain muddy and damp year round, residents do not commonly gather in home gardens; however, gardens are still valued as aesthetically pleasing outdoor spaces.

Moreover, in both communities home gardens provide a leisure activity for many residents, especially to elderly residents in the community. In Carvão, for instance, three of the richest gardens in the community, with 57, 49, and 44 species, are maintained by "retired" farmers, elderly residents who receive pensions from Brazil's social security agency, and who in previous years were dedicated manioc farmers. In Mutuacá, the richest garden, with 41 species, is also maintained by a retired farmer.

As is evident from the diversity of plant types and their uses, the biodiversity maintained in home gardens plays a significant role in the subsistence strategies of local families. Residents value fruits from the home garden as an important supplement to their diets, which tend to be lacking in fresh fruits and vegetables. One mother explained that because they have different fruits coming into season at different times in the year, she and her children never feel too hungry between meals. While fruits in the home garden are the property of the garden owners—in some respects they are also a commonly held resource. Especially in Carvão, children are often seen eating fruits from their neighbors'

garden, and in this way, the planting of individual gardens benefits the entire community.[56] Residents also explained that growing medicinal herbs allows them to address simple health issues in spite of the lack of adequate public health services.[57] One mother, for instance, explained that she plants many medicinal herbs because she has small children, and that when a child has a minor ailment, she has the resources to remedy these problems. Finally, those who maintained herbs and vegetables said they liked to have these materials at their immediate disposal.

In addition to the subsistence value of home gardens, farmers also sell many of the fruits produced in their yards. In Mutuacá, açaí is quickly becoming the most important economic product. Thus, while most farmers reserve açaí from the home garden for subsistence purposes, during the peak production season, many farmers sell excess fruits to middlemen who regularly purchase açaí from area residents. In addition, in both communities, farmers (usually female) occasionally sell fruits, such *pupunha* (*Bactris gasipaes*), *graviola* (*Annona muricata*), *cupuaçu* (*Theobroma grandiflorum*) and *taperebá* (*Spondias mombin*) from their home gardens. In Carvão, for instance, two gardeners sell cupuaçu pulp to the elementary school in Carvão. In 2007, one female farmer proudly told me that she bought a gas stove with the R$450 she earned from cupuaçu pulp. In another case, women reported earning $R1400 in 2006 just from

[56] This custom is accepted by some community members and frowned on by others. Some residents specifically told me that they plant fruits in their gardens so that their children will not resort to "stealing" fruits from others' yards.

[57] In studying health and healing in a caboclo community in the Amazon estuary Reeve (2000) also found that informants relied heavily on medicinal plants as part of their healing strategies in the absence of a public health infrastructure. The use of medicinal plants in Carvão and Mutuacá, however, does not significantly remedy the precarious health situation in the villages. When describing the challenges of living in the study area, residents almost always cited the lack of local health services as among the greatest.

graviola produced in her small home garden, measuring 0.4 ha. Other farmers in Carvão earn sporadic income from pupunha and orange sales during their fruiting seasons. In Mutuacá, two female producers supply the local school with taperebá and cupuaçu pulp during the fruiting season.

Discussion and Conclusions

The landscape of Carvão and Mutuacá is made up of a wide variety of land use types, which are the outcome of farmers' management strategies and the processes of natural forest regeneration. Property visits in both communities indicate that agricultural fields are in decline; in Carvão, old agricultural areas are returning to fallow while in Mutuacá farmers are planting açaí (and thus converting várzea lands to açaízais) to the exclusion of maintaining other land use types. The decline of this agricultural type is a continuation of a trend observed by researchers working in the study areas. Pinedo-Vasquez et al. (2002) observed a decline in agricultural fields in the Foz de Mazagão (from 23 to 18) from 1998 to 1999 in 36 households scattered over the five rivers of the watershed area.

An analysis of farming practices in Carvão illustrates that farmers in Carvão produce manioc mainly for the production of farinha in a process well documented by ethnobotanists and ethnographers in the region (Wagely 1954, Moran 1974, Baleé 1992, Hiroaka 1992). However, as compared to the past, and to other depictions of agricultural practices in caboclo communities, the following changes are observed. Farmers now rely on the use of daily agricultural laborers to aid in the clearing of land and weeding of manioc fields. In addition, in 2007, no farming family reported participating in communal work parties (*mutrião*), which were once common in the region (Wagely 1954). To contend with differences in the structure of the labor pool (in part because adult children

are often tied up studying) farmers have shifted methods of planting and post-harvesting of manioc roots. Data on farmers' management strategies indicates that even though farmers remain traditional—in the sense that all work is done through artisanal methods without the aid of mechanized technologies—farmers have been influenced by agricultural extension policies that attempted to "improve" traditional techniques. This is seen in the case of planting manioc of plants in widely spaced straight lines and by farmers' desire and willingness to experiment with "improved" manioc varieties.

Results of agrobiodiversity surveys suggest that agricultural fields are characterized by low species diversity. In Carvão, however, within declining agricultural fields farmers maintain a relatively high level of manioc varietal diversity. The levels recorded from Carvão are within the average number of varieties recorded in other caboclo communities in Amazonia (Emperarie et al. 2001, Emperarie 2002). During interviews, farmers listed only three varieties that they remember planting and do not plant today. This suggests that the reduction in area in annual cropping occurring over the past 15 years is not having a great impact on manioc varietal diversity. This finding supports arguments made by other plant scientists that cultivated plant diversity often is not a direct function of area. For instance, Brush (2004) argues because of farmers' intervention, the relationship between area and diversity is not linear as it is in some natural systems, and thus a reduction in area does not necessarily have a negative impact on infra-specific diversity. The high incidence of "yellow" manioc varieties reflects the community's economic history and farmers' role as commercial producers who supplied large volumes of farinha to the state agricultural market in Macapá. The selection for these varieties likely occurred in the 1980s when farmers first began to produce farinha

for commercial purposes, and accounts for the lower varietal diversity found in Carvão as compared to indigenous groups in eastern Amazonia who plant upwards of 100 varieties (Emperaire 2002).

Vegetation sampling in the study area indicates that farmers in Carvão and Mutuacá maintain high levels of plant species diversity in relatively small spaces in their home gardens. In Carvão, the home garden is a space where residents continue to experiment with agriculture even when farming is no longer their primary profession. In Mutuacá, farmers compensate for the loss of traditional roçados in part by planting annual crops in their home garden. In both communities levels of home garden agrobiodiversity is higher than levels previously recorded in caboclo communities in the municipality. Pinedo-Vasquez et al. (2002) found that farmers in the Foz de Mazagão maintained on average 17 plant species per garden with a maximum of 26 species in one garden.

While plant species richness is higher in Carvão, the results of an ANOVA test indicate that there is no significant difference between the mean number of species in each sample area (Figure 3.4, Appendix 3.3). The Shannon diversity index values show higher plant species diversity and evenness; the higher β-diversity value for Mutuacá shows that there is greater species variability between the gardens—an observation that can also be inferred from the greater range in species richness found in this community. The results of phytosociological analyses show differences in species composition and their importance values between the two environmental areas, a result of ecology and farmers' management strategies. At the same time, both manga (*Mangifera indica*) and

taperebá (*Spondias mombin*) appear among the five most important trees in both sample areas. Mango is a species that easily regenerates and taperebá is a native species conserved in both locations for its economic value. Furthermore, the correlation analyses show that area and number of individuals and area of the garden are moderately related to plant species richness. That a stronger correlation between area and plant species richness was not found corroborates findings in other studies that suggest that variation in habitat is more important than area in accounting for diversity. Brush (2004) argues that a direct relationship between area and cultivated plant diversity is not always found because cultivated plant diversity is a function of farmer selection and management. In the study area, plant species diversity is linked to farmers' desire to secure access to an array of economic plant species. Farmers' careful manipulation of the home garden to maintain different habitats allows for the cultivation of diversity in these spaces.

In summary, despite shifts away from farming in Carvão and trends of specialization in Mutuacá, farmers conserve plant species diversity in relatively small spaces. These findings corroborate those of other researchers who argue that despite change in smallholder societies across the globe, agrobiodiversity is surprisingly resilient (Brookfield et al. 2002 and Brush 2004). On a landscape level, livelihood shifts in Carvão appear to favor biodiversity—as forest are regenerating in old agricultural areas. In the chapters that follow, however, I describe the processes of urbanization that may undermine this short term gain. In Mutuacá, the long term affect of the açaí boom on levels of plant diversity in the landscape needs further investigation.

CHAPTER FOUR: Representations of the Amazonian Caboclo in Anthropology and Ethnobotany

Preface: On Being a Caboclo

Lula: Seu Antonio, I was trying to explain to Angela what we mean when we say caboclo. I was trying to tell her about the caboclo: What is a caboclo?

Antonio: A caboclo? A caboclo is somebody of the origin; he is somebody who is of the place. But then…I was not born here. I am from Pará (Paraense) and I am a caboclo, well, I consider myself one. And, Anderson and Sônia, they are from here, or at least Sônia is, and they are not caboclos. They drive cars, they are educated. Caboclos are simple people. They are rural workers from the north. I used to work too, but I have found it's not worth it. Here, the more you work, the poorer you become... that is the problem of the caboclo. [58]

[58] Antonio Viega and Lula Dias, Carvão, Brazil.

Introduction

To place the observations from this dissertation into a larger theoretical framework, this chapter reviews the anthropological literature on *caboclos,* defined as poor, rural Amazonians of mixed Amerindian, European, and African descent (Chibnik 1994, Lima 1992; 2000, Harris 2000b, McGrath 2000). Following this introduction, the chapter contains in two main sections. Section one outlines the processes that led to the decimation of diverse Amerindian groups in Amazonia during approximately 250 years of Portuguese colonial rule. It also discusses the significance of the Cabanagem revolt in the years following Brazilian independence to the evolution of the mixed-race peasantry. In addition, I discuss how the rubber trade and how *aviamento*, a form of merchant capitalism based on credit-debt relations that emerged at the onset of the trade, further encouraged racial mixing and basin-wide adoption of the caboclo peasant production system. Section two reviews the major ethnographic literature on caboclo societies in the Brazilian Amazon. In line with the objectives of this dissertation, this section summarizes the literature on the structure of livelihoods, work patterns, and natural resource management in caboclo societies. I also present the major theories that emerge from these studies that attempt to explain how and why economic strategies and patterns of resource management evolved in these societies. This section first summarizes the "early" ethnographies on caboclos based on research conducted before 1970 (e.g. Moran 1974, Wagley 1974, Ross 1978); part two reviews ethnographies conducted after the 1980s. The latter studies outline the broad changes in caboclo livelihood systems following decades of government-led modernization schemes (see Cleary 1993, Nugent 1993, Harris 2000b) and emerging patterns of regional urbanization.

Beginning with Portuguese colonialism, the modern-day history of Amazonia has been wrought with violence, disease and war. The caboclo peasantry emerged in the aftermath of this destructive period and has since endured subsequent boom and bust cycles, changes in modes of regional governance, and the social and environmental effects of development programs. To contend with socio-economic change and environmental variability, caboclos have long maintained diverse, flexible livelihood systems, shifting major economic activities in line with these larger changes. Within the literature review, a trend of increasing livelihood complexity is observed. Modernization schemes following the 1970s increased opportunities for caboclos who integrated forms of urban wage labor into a rural-based livelihood system and today, caboclos may engage in various rural activities, including farming, fishing, fruit and nut gathering, mining, wage labor, or any combination of these and many other activities. Even though caboclos have long shifted between major livelihood activities, the fundamental structure of these production systems has remained the same: Caboclos combine subsistence and market-based activities, such that a proportion of household survival is garnered through natural resource management and the rest through obtaining manufactured products. In addition, even though urban activities are intermittently incorporated into livelihoods, at the core, caboclo production systems in the studies reviewed have remained rural in nature.

The Emergence of the Caboclo Peasantry in Amazonia

Pre-Colonial Amazonia

Before European contact in Amazonia in the 1500s, the region was home to multiple complex Amerindian societies. Reports of early European voyages throughout the region provide a glimpse into this past. Four decades after the Spanish captain Vincente Yanez

Pinzon "discovered" the Amazon River, another Spanish crew headed by Captain Francisco de Orellana made a remarkable yearlong journey from west to east along the main channel of the river (Parker 1985). [59] Caravajal, a scribe to Fransico de Orellana, returned to Spain after the haphazard journey along the Amazon River with rich descriptions of the numerous ("thousands!") of Amerindian groups living along the main regional waterways (Caravajal 1934 cited in Parker 1985). In particular, Caravajal wrote with great excitement of Amerindians dressed in fine extravagant attire who attacked the Spanish ship from large canoes (Mann 2005) near the Tapajos region in Amazonia. Over roughly 250 years of Portuguese rule (from the early 1600s to the 1830s) the majority of these Amerindian groups were killed by European disease and colonial practices that left a landscape largely devoid of people. The forces of colonialism brought together diverse ethnic groups, including Amerindians, Europeans, and Africans; the intermarriage of these groups resulted in the caboclo peasantry, which by the early 1800s was the most populous ethnic group in rural Amazonia. The decimation of diverse Amerindian groups and the subsequent evolution of the caboclo peasantry occurred during the years of colonial rule and the years directly following the retreat of the Portuguese. Below, I describe the violent history of colonialism, which can largely be separated into three time periods: the years of early occupation and colonial rule (1600-1655), the years of Jesuit rule (1655-1755) and the Portuguese Directorate, 1755-1799 (Parker 1985).

[59] Orellana and his crew found themselves traveling east on the Amazon River after becoming separated from a larger expedition headed by the Spanish explorer Gonzalo Pizarro to find the fabled City of Gold (*El Dorado*). When the original expedition went awry, Orellana was sent from the area of the headwaters of Ecuador in search of food and/or friendly Indians. Orellana and his crew soon became lost and decided to head east in hope of finding the mouth of the river and the Atlantic Ocean to eventually return to Europe.

The Arrival of the Portuguese

About a hundred years after the Portuguese first landed in Brazil, and 70 years after they had established successful sugar plantations in its southerly provinces, the Crown launched a policy to gain control over Amazonia. Like all of their colonial missions, the Portuguese were motivated by the prospect of profiting from the extraction and trade of plant products of commercial value found in the rich tropical rainforests. In the early years, the Portuguese search for diverse plant products of culinary value included "…cloves, oleaginious seeds, pixurim (a substitute for nutmeg), vanilla, annatto, sarsaparilla, carajuru (a bark including a red dye), cacao, senna and cravo, an aromatic bark used as a substitute for cloves (Gross 1969: 269; Sweet 1974: 57 cited in Parker 1985:7)," which were collectively referred to as *drogas de sertão* (backland drugs). Before the Portuguese could proceed with the forest collection activities, however, they first had to secure their domain in this remote region—a task that meant expelling other Europeans, the English, French and Dutch, who had long ago established a number of trading posts in eastern Amazonia (from the mouth of the Amazon River to Xingu River in the state of Pará) and had maintained friendly trading relations with Tupi Amerindian groups (Parker 1985). In the early 1600s, without negotiation, the Portuguese moved into the region and worked quickly to expand geographic control. The Portuguese military first destroyed English, Dutch, and French forts and posts, and secured the mouth of the Amazon River, a move that would prevent other nations from accessing the western interior of the river basin. In 1616, the Portuguese invaded a French fort near the present-day city of São Luis in Maranhão, and established a base near Belém do Pará in the

mouth of the river a strategic move to prevent other nations gaining access to the western interior portions of the Amazon River Basin (Parker 1985),.

Outside of Amazonia, the economy of colonial Brazil was almost entirely based on plantation agriculture. The Crown modified its economic strategies in Amazonia, as the extraction of forest products was an activity that required little financial investment and developing infrastructure in this remote region would have been more complicated. While the products were found "free" in the forest, many plant species (the sources of the products) displayed a scattered distribution, and thus to profit from their collection, Portuguese settlers needed a steady supply of laborers to disperse throughout the region collecting the plant materials. Because of their specialized knowledge of the forest, Amerindians were ideal for this type of work (the Portuguese subsequently deemed African slaves working on plantations in the Northeast ill-suited to the tropical rainforest environment). Shortly after their arrival, Portuguese settlers quickly sought to enlist Amerindian labor (Parker 1985). In the early years (circa 1616), Portuguese colonists in Amazonia, who were poor themselves and could not pay Indians for their labor, bartered with Amerindian groups for their labor. In exchange for European goods, the Portuguese requested Indian detainees who were being held captive by warring tribes. This strategy worked for a time; however, over the next decade when labor shortages became more drastic, the settlers resorted to brutal tactics and began to raid Indian villages, capturing men who were forced to work as slaves under settlers' supervision. Because by Portuguese law slave raiding was illegal, the settlers disguised their raids as rescue missions (*tropes de rescates*) claiming to free Indians being detained in the villages of rival tribe supposedly being fattened for consumption purposes (Hemming 1978). The

slave raids were brutal and resulted in a largely skewed native demography, where men were largely removed from Indian villages. The raids were even more destructive, however, as a mechanism for the spread of smallpox and other Europeans diseases. Smallpox was so deadly that entire villages were killed off in a number of years. By the end of 1637, just a few decades after Portuguese took control of the region, virtually all of the Amerindian groups in the lower Amazon were destroyed (Parker 1985).

The Arrival of the Jesuits

Alarmed by the reports of Amerindian slaughter in Amazonia that were occurring despite settlers' complaints of ongoing labor shortages, in 1647 the Portuguese Crown dispatched the Society of Jesus (the Jesuits) to Amazonia. The society was charged with responsibility of overseeing social and economic affairs in the colony. In particular, the Jesuits were instructed to pacify Amerindians through religious teaching and gain their labor cooperation. Upon arriving in the colony, the Jesuits quickly established their domain in the region. They first built small villages with houses and churches and set about recruiting Amerindians to join the mission. Amerindians were technically free citizens of the Portuguese Crown, so they were not forced to join mission villages, but could choose their place of residence. However, because the Jesuit villages offered Amerindians protection from the Portuguese settlers who were not permitted to enter missions without formal permission, Amerindians were easily recruited into villages. Within two years of their arrival (by 1655) the society had established 54 mission villages in eastern Amazonia (Kieman 1954). Mission villages were placed along the major rivers and tributaries of the region. The initial network of villages later allowed the Jesuits to

expand their control westward, forming additional mission villages and trade networks (Parker 1985).

While the Crown had dispatched the Jesuits for the purposes of solving the labor question in the region, the society was most interested in furthering its own mission. To sustain the society, and to continue to spread the word of God, the Jesuits needed to make money in Amazonia. Thus, while in the years directly following their arrival in the colony, the Jesuits granted settlers' requests for Amerindian labor, they soon ignored these requests to reserve Indians for their own purposes. In and around the missions, Amerindians worked in the forests extracting commodities traded for the society; they also fished, farmed, hunted and collected plants from the forest to provision food for themselves and for the religious leaders. In part because the Jesuits had access to Indian labor, but also because religious leaders spoke Tupi-Gurani, a language that settlers did not understand, from 1655 to 1755, the Jesuits were the prominent traders in the region. Because the Jesuits did not have to pay taxes to the Crown (as a religious order), the society had economic successes that the settlers had never been able to achieve (MacLachlan 1973).

More humane and respectful of Indian customs than other mission groups in the Americas, the Jesuits permitted Amerindians to maintain their social alignments and structures in the mission villages. At the same time, however, mission life was inherently destructive to Amerindian cultural patterns; after all, its entire objective was to convert Amerindians to Christianity and break down local religious customs. In addition, religious teachings were aided by a parallel teaching of a new *lingua geral*, Tupi-Guarani

(a pidgin language that borrowed from the most common languages in the region) that came to replace hundreds of local Indian languages (Parker 1985, Ross 1978). Finally, and perhaps most importantly, work and living patterns inside mission villages increased Amerindian dependence on outside European goods, and, as Parker (1985) argues, effectively transformed Indians from subsistence producers to commodity producers.

The End of Jesuit Rule and the Portuguese Directorate

The economic success of the religious society angered the settlers who continued to be poor and without a steady labor supply to continue their economic endeavors. In part because of settlers' protests, the new Portuguese prime minister Marquis Pombal sent representatives to investigate Jesuit affairs in the colony. Afterward the Jesuits were accused of failing to pacify the Amerindians (the original goal of their mission) and were expelled from the colony in 1757. A new plan, the Portuguese Directorate Act, was devised for the region. The Portuguese Directorate Act was a powerful piece of legislation with two main purposes. It first called for the creation (or re-creation) of a civil society in Amazonia, which over the last 100 years had largely been controlled by a religious order, and then outlined an economic policy for the region. In the short term, the Act addressed the labor needs of settlers and the trade economy (Parker 1985). In the long term, the Act called for the establishment of an agricultural economy in Amazonia modeled after the plantation systems in the Northeast of Brazil. New experiments in plantation agriculture were to center on cotton, tobacco, cacao, and coffee, crops that typically grew well in the region (MacLachlan 1973). The long term economic policy reflected commonly held beliefs that economic development could not be sustained on the basis of forest collection alone.

To address its first goal of creating a unified civil society, the Act mandated the consolidation of Jesuit missions into larger villages governed by a village director in charge of overseeing its operations. In addition, Portuguese was reinstated as the *linga geral,* a change deemed necessary to "civilize" Amerindians groups and to bring them under the administration of the Crown. To further encourage integration and union, intermarriage between Amerindians and Europeans was officially promoted. Furthermore, mission directors prohibited indigenous dress and outlawed communal living in traditional longhouses (Ross 1978). All of these practices thus advanced the evolution of a mixed race (caboclo) society where cultural practices displayed a hybrid form based on the traditions of Europeans and Amerindians and would be the only part of the Act that actually met its stated goals.

To address labor shortages, the Act stated that Amerindian labor force would be divided in half: fifty percent of the force was to be reserved for use in the village—to grow food and sustain other government projects; the other half was reserved for settlers' endeavors. On the ground, however, the policy was not enforced. Greedy to make their own profits, village directors denied the settlers their share of the labor pool and used Indians for their personal economic pursuits. Thus in the end, the Directorate Act did not ameliorate the labor shortage in the colony, but rather saw the continued exploitation of Indian labor.

Moreover, the Directorate Act also failed to meet its goal of establishing plantations in Amazonia. In the early years, the Crown encouraged plantation agriculture by extending tax relief and grants to settlers who pursued this end. To deal with labor

shortages, African slaves were also imported into the region by the Companhia Geral Pará e Maranhão. However, due to logistical problems, slaves never reached Amazonia in the numbers required to sustain plantations. While there were small successes in rice cultivation in Amapá and cotton production in Maranhão, production never reached the level that the Crown desired. The Portuguese's experiments with plantations are important to this discussion on the evolution of the caboclo class, as it brought another large cultural group, African slaves belonging to many nations and cultural groups to Amazonia (Carney 2003) and thus further enriched the cultural basis of the caboclo class.

The Evolution of the Caboclo Mode of Production

During the years of the Directorate Act, an informal trade economy operating outside of official sanctions gained strength in Amazonia. Fluvial traders patrolled the region in canoes and bartered with detribalized Indians (caboclos) and settlers, trading forest products for household goods and for sugar cane liquor, which had further deleterious effects on remaining indigenous groups. When the economic situation in Amazonia became unviable due in part to the growth of the informal economy, the Portuguese abandoned the Directorate in 1799 and lost interest in Amazonia. With the retreat of the Portuguese, the region was free from central control for over 60 years (Harris 1998; 2000b). Because few documents from this period remain, we can only speculate as to how the survivors of colonialism—disbanded Amerindian groups,[60] residents of mixed unions, former African slaves, and the impoverished Portuguese colonists—got on with

[60] Most indigenous peoples were killed during Portuguese colonial rule. However, a number of groups fled their native homelands to the interior of the continent far from the reaches of slaving colonists. Today large indigenous groups, such as the Beni in Bolivia and the Yanomami of northern Brazil and southern Venezuela live in areas to which their ancestors fled over the course of centuries of colonial rule and further disruption.

everyday life. Some authors believe that after mission villages were destroyed, individual families (many times the product of Amerindian and Portuguese unions) walked along rivers and streams of the floodplains and established small isolated residences of up to a few families (Ross 1978, Parker 1985) These families would have continued to trade forest products with itinerant traders who controlled the value of commodities and were linked to local, regional, and export markets. In addition, families practiced subsistence fishing and hunting, activities that were supplemented with subsistence agriculture (through swidden-fallow methods) practiced across the diverse environmental areas of the region (Parker 1985). This general mode of production—the integration of market-based activities, namely the extraction of forest products, with subsistence activities—became a cornerstone of socio-economic life for caboclo families (Moran 1974). This mode of production is referred to throughout the chapter as the "traditional" mode of economic production. Caboclo economies have thus long integrated commercial activities, which have linked these peasant societies to the external markets and regional economies; they have also included subsistence activities that have buffered residents them from external market forces, allowing caboclos to maintain a degree of independence.[61]

Cabanagem and the Amazonian Caboclo

In the years following Brazilian independence, Amazonia became yet again a site of violence. Independence from Portugal sparked massive social movements in eastern

[61] The structure of caboclo economies in Amazonia follows Gudeman and Rivera's model for peasant economies in the eastern Andes of Colombia. Gudeman and Rivera (1994) discuss how subsistence activities rooted in the land have buffered farmers from abrupt market changes. He also argues that anthropologists have studied peasants' market activities to the neglect of other alternative modes of production.

Amazonia, the most wide-reaching being the Cabanagem revolution, during which a third of Amazonian residents died over the course of its three-year duration between 1833 and 1836 (Anderson 1985). The revolution occurred as a result of clashing interests between two broad social classes—an elite group of Portuguese loyalists and native-born urban entrepreneurs who wanted to free themselves from the control of northeastern and southeastern Brazilian elites. These native-born entrepreneurs aligned themselves with urban workers, caboclos, and ex-slaves, and waged a civil war with the intent of gaining control of the regional government (and thus usurping power from the entrenched elite loyalists). The rebel group (the *cabanos,* named after their dwelling places) assassinated the president of the regional government and installed a compromise candidate—who in the end stood in the way of the rebels' goal of restricting power amongst the elite. The bloody movement sparked violence throughout all of eastern Amazonia, was eventually stalled, and then shut down by southern Brazilian troops who acted in the interest of the loyalists.

The Cabanagem revolution is important to the evolution of the caboclo class in two different ways. First, it further encouraged the process of population dispersal into the rural areas around towns, as families fled violence in the cities, left urban settlements, and settled on várzea areas further from town a (Harris 2000b). Families that fled into the interior took up a caboclo mode of existence, trading forest products and practicing subsistence agriculture, hunting and fishing. After Cabanagem, the várzea became more densely populated and the system of informal trade between merchants and peasants became well established by 1840 (Harris 2000b). Second, the revolution was significant because it promoted a sense of class consciousness among the caboclo peasantry

(Anderson 1985). Because the caboclos fought on the side of the cabanos, the revolution solidified the peasants' low social position vis-à-vis the local elite who at the time controlled the merchant trading economy (Anderson 1985).

The Amazonian Rubber Boom and the Caboclo (1850-1910)

After the chaos of Cabanagem, Amazonia was drawn into a new frenzy. Far from Amazonia, Charles Goodyear finalized his invention of the vulcanization process for curing natural rubber. This innovation coupled with the rapid growth of the automobile industry in the United States created a new demand for Amazonian rubber (*Hevea brasiliensis*)—found in great quantities in the basin. The region, previously unknown to most across the globe, soon became of central importance to the progress of western industrialization. Historical accounts of the Amazonian rubber boom depict an initial excitement and optimism. Foreign-owned trading companies "stampeded" into the region and bought up portions of rubber-rich land, first in the mouth of the Amazon River, and later in more remote western areas. Almost immediately, Amazonians from all social classes were pulled into the trade and into the global market to an unprecedented degree. Rubber was funneled from import-export houses based in Belém and Manaus to the United States and to Europe in great quantities. At the peak of the trade, 10 million kilos of rubber per year were exported from the region. Regional profits soared and gave way to a bourgeois society that flourished in regional cities.[62] Many historians still consider the rubber boom the "most significant" economic period in Amazonia history (Weinstein 1983; 1985). The trade was remarkable in its volume of exports, but also because of its geographical extent. Rubber was collected throughout all of Amazonia, from the mouth

[62] During the rubber boom a famous opera house was built in the city of Manaus. The construction materials for this gigantic building were imported from across Europe (Moran 1974).

of the river to the western Brazilian state of Acre, into Peru and Bolivia. Despite its short duration (1840-1910), the rubber boom had long-lasting social and economic effects in Amazonia. Among the most significant was the rise of *aviamento*, a system of merchant capitalism based on credit-debt relations that to some degree still prevails in contemporary Amazonia. Below I discuss how the dynamics of the rubber trade and aviamento more specifically coupled with the remoteness of the region further encouraged the evolution of the caboclo peasantry.

Foreign-owned trading companies faced many of the same obstacles that the Portuguese settlers confronted at the beginning of the colonial period when establishing trade networks based on forest extraction. The low population density of *H. brasiliensis* trees meant that to meet international demand, rubber needed to be collected over great distances in Amazonia.[63] Trading companies thus needed access to large tracts of land and a strong labor force. During the early years of the trade, rural workers, indigenous peoples, ex-slaves, and caboclos already living in rural Amazonia were quickly incorporated into the trade and distributed throughout the region to tap rubber on trails (*estradas*) made up of 120 to 150 trees (Weinsten 1985). In particular, Weinstein describes how the nature of rubber tapping, as a solitary activity, divided various remaining Amerindian groups who had up until the mid-1800s maintained a traditional lifestyle, working and living communally. Because trails were often separated by great distances, and families tended to place their houses in close vicinity of the areas where they were collecting, families of the same cultural group were isolated from one another,

[63] Wild rubber is extracted through artisanal methods of cutting (tapping) and capturing the free-flowing latex in small containers.

and in the process many traditional practices were abandoned. Over time, families separated from communal living spaces began to adopt a model of caboclo production, where subsistence and commercial activities revolve around the nuclear family. Finally, to meet additional labor demands, urban trading companies recruited peasants from the poor drought-ridden states of the Northeast of Brazil to work on Amazonian rubber trails.[64] Northeasterners contributed to the regional diversity; this movement of diverse peoples to faraway corners of Amazonia facilitated the process of intermarriage and racial mixing that began with colonialism (Weinstein 1985).

Caboclos, Amerindians, and immigrants from other regions in Brazil became integrated into the aviamento trade system that emerged in Amazonia at the beginning of the boom as a way to distribute manpower throughout the region and quickly bring new areas under production at a rapid pace and thereby with little risk to the urban trading house, *casa aviador* (McGrath 2000).

Aviamento involved a host of actors linked to one another through credit and debt relations. On the lowest rung of the ladder were the rubber tappers who were associated with a local *patrão* or *aviador* (a middleman or supplier) who either owned land on which rubber trails were cut or was employed by a distant landowner. In either case, the patrão operated a local trading post, called a *comércio* or *barracão.* At the beginning of a new rubber tapper's tenure, the patrão "lent" the tapper supplies needed to begin

[64] The historian Euclides da Cunha (cited in Wagely 1974) wrote that the owners of rubber estates sent agents to the Northeast of Brazil to recruit rubber tappers. Northeasterners were brought to the region under strict debt conditions. Euclides da Cunha recalled that the tapper began to owe his patrão from the moment that he left his home community. He owed money for the passage on boats to the interior and money for supplies to last him through his first year of tapping. The patrão charged so much for the goods that the tapper rarely paid off his debts within the first two years and in many cases was never free from debt.

collecting rubber. The original debts accrued by the tapper were then repaid in the form of rubber. Each month the tapper "sold" or exchanged his rubber to pay back his original debts and to purchase dry foods and household goods using wild rubber as a form of currency. Within this system the patrão was clearly in a powerful position vis-à-vis the rubber tapper; however, the patrão himself had obligations. To establish his trading post, the patrão acquired goods from an urban merchant in a regional city. This merchant was in turn indebted to the import-export company operating out of Belém or Manaus. Just as the tapper repaid his patrão in wild rubber, debts along this hierarchical chain were also repaid in exchange for wild rubber (McGrath 2000).

During the rubber boom the experience of the rubber tapper varied across the region, but in most cases was determined by the decency of the patrão. Daily life for rubber tappers and their families often played out in small-scale power struggles between the patrão and his producers (also called clients or tappers), and debt played a central role in this ongoing struggle. The system of aviamento put the patrão in a position of power because the rubber tapper's debt obligation tied the tapper and his family to a specific piece of land, which was owned or controlled by the patrão (McGrath 2000). By this measure, if the patrão could keep his workers in continual debt he could prolong his tappers' tenure in the interior and to some degree prolong the continual extraction of rubber. To keep clients in continual debt, the patrão often manipulated prices of both manufactured goods and wild rubber. The patrões' manipulation of prices combined with the "natural" fluctuation of goods in the region meant that producers and their families could not survive on these goods alone, but rather needed to produce their own food (Weinstein 1985). Thus families maintained a livelihood system based on the integration

of diverse subsistence activities with commercial extraction of wild rubber.[65] For rubber tappers, participating in the rubber trade was not often a means of accumulating wealth, but rather a way to obtain the outside goods on which rural Amazonians had to some degree become dependent. (For instance, families exchanged rubber for coffee and sugar—products not easily grown—along with metal household objects, and in some areas manioc flour, the regional carbohydrate staple that is not easily grown in the várzea). Weinstein (1985) argues that the patrão's perverse incentives led people of all backgrounds—migrants from the Northeast, ex-slaves and Amerindians—to adopt the mixed caboclo production model.[66] When rubber plantations in Asia took hold by 1915, and demand for *H. brasiliensis* fell due to competition and a rubber trade weakened by increased supply, many migrants returned to the northeast. However, many others stayed in the region, and because they maintained subsistence production, these families were buffered from the shock of the bust.

[65] I include this point because it speaks against the normative explanations of why rubber tappers were not productive during the rubber boom years. From the beginning, owners of import-export companies marveled at tappers' "lack" of productivity and attributed it the inherent laziness of native-born Amazonians. Aside from simply needing more workers to extract rubber, recruiters also hoped to find "more productive workers" in the northeastern migrants. Newspaper articles at the time even suggested importing Japanese or Chinese workers, who were considered inherently better workers, to increase exports leaving the region. Elites, blinded by their own racism, were incapable of understanding the true casues of workers' unproductivity, such as demoralizing power differences between the worker and the patrão.

[66] Maintaining autonomy by engaging in subsistence practices was just one of the resistance strategies used by tappers in their dealings with the patrão. To obtain goods at a lower price (or goods that the patrão did no have), tappers also traded secretly with *regatões* (fluvial traders). In some cases, exchanging with the regatão was a way to obtain currency in a time when aviamento based on barter was most common throughout the region. See McGrath (1999; 2000) for a full account of the importance of the regatão in caboclo resistance.

Representations of Caboclo Economies in Anthropology

Early ethnographies (1953-1978)

Charles Wagley and his team of researchers arrived in the community of Itá[67] in the estuary of the Amazon in 1948—30 years after the price of wild rubber had plummeted on the world market. Wagley's ethnography *Amazon Town* was the first anthropological study of caboclos in the Brazilian Amazon; in previous years ethnographic work was limited to the study of remaining Amerindian societies. Research for Wagley's monograph (first published in 1953) was based on fieldwork conducted in the terra firme town Itá and the villages that lined its nearby tributaries (*igarapés*).[68] Itá is located along the south bank of the Amazon River, and at the time of writing was the administrative seat of the municipality by the same name. During this time, a weak form of aviamento prevailed in the region and settlement patterns followed a traditional pattern. Small hamlets lined the region's waterways in clusters arranged around interior trading posts. Manuas and Belém served as depot-cities that accumulated forest and agricultural products, exported them to the rest of the globe, and conversely received and distributed manufactured goods throughout Amazonia (Ross 1978, Browder and Godfrey 1990).

[67] Following the anthropological tradition of the time, Wagely provided the fictive name of Itá for the town of Gurupá located in the municipality of Gurupá (state of Pará, Brazil).

[68] Moran (1974) and Ross (1978) derive larger theories of caboclo social and economic production and the evolution of this economy from Wagley's insights and observations. *Amazon Town* remained the only monograph on caboclo societies published in English until the 1980s.

Rural livelihood strategies in Itá

Caboclos in Itá [69] maintained a rural-based livelihood system that combined subsistence and commercial activities carried out over the diversity of the estuarine landscape surrounding Itá. At the time of research, manioc farming [70] in the terra firme and the collection of forest products, including wild rubber and oil producing seeds (exported for their use in soap-making and/or as lighter fluid oils) from the following plant species: *ucuuba* palm, *pracaxi*, *copaiba*, *patúa*, and *andiroba*, were the two primary income earning activities in the region. Work in Itá generally followed a seasonal pattern, where farmers prepared and planted their manioc fields in the upland surrounding Itá during the late summer and early winter months (from November to March), and moved to the várzea lowlands during the summer to collect forest products. At various points during the year, farmers harvested the manioc roots from the previous year's fields (as the edible roots take up to one year to develop) and processed the roots into coarse manioc flour (*farinha*), the regional carbohydrate. The farmer then sold a portion of the harvest and reserved the rest for personal consumption. Because markets for forest products were in constant flux with prices varying dramatically year to year or within the course of a few months, farmers would sometimes substitute manioc farming for the collection of forest products or vice versa. Wagley noted for instance: "In the years when rubber prices are

[69] In his monograph, Wagley distinguishes between two groups of rural producers living in and around Itá. He calls the rural farmers who live in the uplands of Itá peasants or farmers, and reserves the term "caboclo" for those who reside in the várzea near Itá. This chapter follows the work of scholars such as Parker (1985) who classify both groups as caboclos. As will be seen in the chapter discussion, it is difficult to make a clear distinction between the production regimes of both groups. Each depends on terra firme and várzea areas to maintain their livelihoods, such that an upland "peasant" becomes a várzea collector over the course of the year.

[70] Manioc or cassava has long been the staple carbohydrate in Amazonia. When the Portuguese arrived in Amazonia indigenous groups were already growing and producing manioc flour through an artisanal process that is still in use today. Manioc is one of the few crops capable of growing in the latosols of the terra firme and has the added advantage of remaining viable in the soil for a year, and in some varieties for two years (Ross 1978).

high…families move across the Amazon mainstream to the island lowlands abandoning their farms to collect rubber. When the prices drop, there is a steady migration to terra firme and to farming (Wagely 1974:142)." By focusing on production of manioc, a crop that requires limited labor input after fields are planted and one that lives in the soil for up to two years, caboclos were able to take advantage of upswings in the market. The strategy of coupling manioc farming with the collection of forest products was not unique to Itá but rather a strategy employed across Amazonia after the rubber boom to guarantee caboclos a means of accessing manufactured goods (Ross 1978).

In Itá the prices of forest and agricultural products were low compared to imported goods; therefore, even when coupling manioc farming with extractive industries, caboclos could not live on these activities. To survive, families needed to produce their own food. Wagely's ethnography provides rich descriptions of subsistence practices and the local technologies used in farming, fishing, and hunting. Wagley observed that fish in particular were an important source of protein in Itá. Caboclos used European hook and line techniques and indigenous practices, such as stupefying fish with natural poisons,[71] setting fish traps, trapping in igarapés with nets, and hunting fish with bow and arrows and harpoons (Moran 1974). Because local game stocks around Itá had long been depleted due to years of continual occupation, hunting was practiced more as a hobby or pastime; however, in the more remote caboclo villages in Amazonia, game, including: paca (*Agouti paca*), nine-banded armadillo, (*tatu*, *Dasypus novemcintus*), agouti (*cutias*, *Dasyprocta* sp.), Red brocket deer (*veado*, *Mazama americana*), wild pig,

[71] The root of the *timbó* plant (*Lonchocarpus urucu*) was a common source of poison used to stun fish in the shallow waters of igarapés and oxbow lakes in region.

duck, and various monkey species (Moran 1974). Finally, farmers in Itá planted various crops in várzea fields, including squash, maize, yams, sweet potatoes, watermelon, peppers, rice, beans, bananas, and papaya. Fruit trees and other annual crops were planted around homesteads in both terra firme and várzea areas. Fruits and vegetables planted in caboclo gardens were an important complement to the manioc-based diet and provided essential nutrition to caboclo households.

In his ethnography, Wagely emphasized the very rural nature of economic systems in Itá, and thus concluded that families' survival was for the most part linked to effective natural resource management. Wagely also describes how caboclos' wellbeing was impacted by regional social patterns and systems of hierarchy. All rural producers in Itá were enmeshed in credit-debt relations with local traders and storekeepers. Farmers sold farinha and manioc-derived products to a single buyer in Itá who a caboclo designated as his patrão. These buyers advanced food staples and other goods on credit to farmers, and thus the debt relationship served to tie farmers to a specific buyer. Large tracts in the várzea near Itá were at the time owned by Dona Dora Cesar Andrade, a shopkeeper in Itá. Dona Dora customarily advanced food and merchandise on credit in exchange for forest and agricultural products from farmers who also paid rent to live on her land. In the rubber collecting areas near Itá, a trader-customer relationship typical of aviamento still existed. Trading post owners held deeds to a large portion of land and rented rubber trails to their clients. In return, the tappers were expected to trade at the designated post. In these rural areas, the trading post also served as the center of social life, around which schools and community centers were constructed.

In his description of social life, Wagley describes credit-debt relations in and around Itá as mild compared to the system of aviamento that prevailed during the days of the rubber boom. He explains that merchants and traders in Itá in were left impoverished by the crash at the end of the rubber era. Without the backing of powerful rubber barons, landowners such as Dona Dora had only precarious control over their lands. In addition, landholders' "titles" were no longer legitimate legal documents, but rather a record of the process of land acquisition. Without authority, landowners could not effectively force producers to trade in at their specific stores. Thus, Wagely observed caboclos trading with various merchants (other than a designated patrão) during the evening hours. In addition, caboclos living in the várzea often bartered in secret with fluvial traders (*regatões* or *regatão*, singular).

At the same time, caboclos took great care to hide these transactions and for the most part to uphold an exclusive relationship. Wagley explains that maintaining a sense of loyalty with members of the merchant and elite classes[72] was beneficial to poorer residents in Itá. Because a "good" patrão took interest in the wellbeing of his client's family, maintaining friendly relationships with these powerful figures was a way to increase livelihood security. For instance, in times of need residents often approached the patrão to request an extension of credit or for access to his resources, such as boats; in the interior the patrão often used his position of privilege to settle land disputes between neighbors or family members (Moran 1974). To form more solid bonds to the elite, Wagely observed that caboclos often asked more "powerful" individuals to serve as

[72] The small elite class in Itá included Dona Dora and her family, the local schoolteacher and her family, healthcare workers, the mayor and other higher government administrators.

godparents of their children. Within the traditional Amazonian society, the godparent becomes a second mother or father to his/her godchildren, and thus has more of an obligation to help the family during times of financial need (Moran 1974, Wagley 1974, Parker 1985).

Theoretical contributions of early ethnographers

In addition to describing patterns of natural resource management in Amazonia, early ethnographers also developed theories to explain the evolution of specific social and economic patterns in caboclo societies.[73] Wagley and Moran came from a tradition of cultural ecology that argues that the environment is most important in determining socio-cultural patterns in peasant (non-Western) societies across the globe (Nugent 1993, Harris 2000b). Central to cultural ecology was the theory of human adaptation to the environment. Culture in "primitive" societies was thought to unfold within the confines of the environment—or in other words, humans adapted to the environmental restrictions of their locale. In the case of Amazonia, the limitations of the environment included the relative infertility of terra firme soils and the dynamism of the várzea where landforms were constantly being formed and reformed by flood regimes. Wagley (1954) and Moran (1974) argued that these challenges were mediated through cultural scripts (knowledge) derived from indigenous Amazonian societies, and that this knowledge, dictating natural resource management, allowed the caboclo class to adapt to the environment and survive in the aftermath of colonialism. Following this model, Wagley argues that in Itá livelihood diversity is derived from the natural biodiversity of the region, and that

[73] For instance, Wagley concludes his analysis of social life in Itá by describing the inherent difficulties of development in the disease-infested tropics.

residents' movement across the landscape is partially attributable to dramatic seasonal changes typical of the eastern Amazon, which greatly impacts the availability of natural resources.

The closely related theme of economic accommodation also runs through the early literature on caboclos. For instance, in his essay on the evolution of the caboclo peasantry in Amazonia, Ross (1978) states "…economic patterns in peasant societies can be seen as an adaptive response to the limits imposed upon the environment and by the political economy of capitalism.[74]" In his essay, Ross discusses how the regional dominance in forest extraction activities promoted observed settlement patterns, where small groups of extended kin are concentrated around trading posts; and that due to their dependence on outside goods (developed during colonial times) caboclos have essentially been pawns to these forces, traveling to and from collection areas according to shifts in markets. Thus, the two themes of ecological adaptation and economic accommodation are closely related (Harris 2000b). The early ethnographers called attention to the constraints within which caboclos lived, arguing that caboclo societies (and their economic systems) were the products of environmental limitations and political and economic forces acting upon the local society. Describing the impact of larger economic forces on socio-economic patterns in caboclo societies, the authors hoped to speak against racist ideas surrounding the impoverished condition of caboclos (relative to Western standards). Outsiders and travelers to the region, as well as people from the

[74] One of the main objectives of Ross' (1978) essay is to explain why caboclos do not cultivate the fertile várzea soils, which are inundated daily or seasonally. Outside observers and travelers to the region in Amazonia credited this phenomenon to caboclos' stupidity or laziness. Ross provides a critical analysis of the situation based on larger political and economic considerations.

merchant and elite classes in Amazonia believed that caboclos' poverty was due to an inherent laziness and "collecting mentality" prevented them from engaging in more stable forms of agricultural production (Ross 1978), which are more conducive to economic development.

Later Ethnographies (1990-2000)

The ethnographies on caboclos in the Brazilian Amazon that followed Wagley, Moran, and Ross were written several decades after a series of development and modernization schemes caused a complete reorganization of the social space in Amazonia, changes that had a direct impact on caboclo societies in Amazonia. The Juscelino Kubitschek de Oliveira government that came to power in 1954 was concerned that the Amazon, vacant of people and lacking a state presence, posed threats to national security, and that its sleepy economy was hindering Brazil's economic growth (Browder and Godfrey 1990: 106). In 1956, the president declared that his government (a military dictatorship) would lead the Amazon to "fifty years of progress in five years" (McCleary 1990:19). From the mid-1960s until 1987, the military government launched a number of programs aimed at integrating the Amazon into the state apparatus, thereby increasing national security, and at promoting large-scale economic growth in Amazonia. Early development programs emphasized regional integration through highway building and the establishment of planned agricultural colonies along these new roadways. By the late 1970s, modernization programs promoted large-scale development projects in cattle ranching, mining, timber, and hydroelectric dams by offering tax incentives and other benefits to

national and international investors (Browder and Godfrey 1990).[75]These development schemes transformed historic demographic patterns in Amazonia. Roads were cut through terra firme forests and supplanted waterways as major regional transportation routes. New urban centers emerged in interior upland regions away from historic cities (settled during colonialism as ports to receive and export goods). State-funded agricultural colonies were built in terra firme areas across Amazonia, first along new highways, and then in the interior regions of the basin (Browder and Godfrey 1997). Landless peasants from the southeast and northeast of Brazil were settled in these new communities, which were directly tied to the federal government, and dependent upon its support and services. Private companies established modern company towns to house employees working in company mines or operating (and/or building) hydroelectric dams. Shanty towns emerged in the peripheries of these planned towns. The growth of these urban centers was fueled by a growing informal sector providing ancillary support industries to residents in these company towns. A new development plan, whose aim was to stimulate the formal economy in Amazonia, ironically gave rise to the informal service sector operating outside of the confines of the formal economy; this sector today employs the majority of Amazonia's urban dwellers (Cleary 1993).

[75] The first development program passed by the federal government for the region was called "Operation Amazonia," and consisted of a series of legislation, passed in 1966 to 1967, which called for the following: the construction of Belém-Brasilia highway to link Amazonia to the southern and central states; agrarian reform programs to relocate poor peasants from the northeast and south to the Amazon (to provide land for the landless in a land without people); and economic incentives for large-scale industrial and agricultural activities in the region (Mahar 1989:10-23). In 1970, the National Integration Program was passed, calling for the construction of the Transamazon and Cuiaba-Santerém highways, and land settlement programs along these highways (Mahar 1989). Finally, from the mid-1970s to 1987, the Program of Agricultural, Livestock, and Mineral Poles in Amazonia (POLOAMAZONIA) supported large-scale development activities for mining, cattle ranching, and logging through tax incentives and infrastructure development (Mahar 1989).

Ethnographers returning to the Amazon documented the effects of development and resulting patterns of urbanization on caboclo livelihoods across the basin. Working in the Santerém region, state of Para, Brazil, Stephen Nugent (1993) observed that in modern Amazonia caboclo livelihoods had become even more diverse and complex. Mining projects and investments in cattle ranching had increased formal wage labor opportunities for caboclos. These industries also propelled a parallel informal economy that further increased cash income-earning opportunities for caboclos in Amazonia. In the greater Santerém area, Nugent observed that caboclos migrated seasonally in search of short-term employment in the formal and informal service sectors. Caboclos also engaged in petty commodity production, selling goods to urban consumers in new and sprawling cities. Nugent argued that modern-day caboclo economic systems depended, not only on maintaining access to diverse natural environments, but also on securing access to urban spaces and resources. In his ethnography, Nugent elaborates a new model of caboclo livelihood production, which updates the model described by early ethnographers based on the integration of diverse rural activities. Calling this model the caboclo-complex, Nugent summarizes it as "an extensive form resource use embracing agriculture, terrestrial and riverine extraction, small-scale mercantile activities, wage labour and the production of goods and services in the urban setting (Nugent 1993:179)." While Nugent describes the role of urban centers to caboclo livelihoods, he also points out that urban employment opportunities are fleeting and unstable forms of work (as they are often associated with activities, such as mining, that provide only short-term jobs). The caboclo economy is thus still ultimately dependent upon maintaining access to natural resources. Nugent argues that caboclos' ability to fall back upon diverse rural activities has

historically allowed them to weather the shock of boom and bust cycles, and must be maintained in the present to maintain economic security. In the present, however, caboclos, who occupy a low socio-economic position, are in a compromised position in modern-day Amazonia where there are competing interests for land use.[76]

In an essay on the political economy in modern-day Amazonia, Cleary (1993) provides three additional insights on changes in caboclo livelihoods. Cleary first argues that after modernization, caboclo livelihoods not only diversified (or included a greater number of activities), but that caboclos today work under various labor regimes and within different economic systems. New capitalist projects provided wage labor opportunities for the traditional Amazonian peasantry, and caboclos were integrated into a semi-proletariat and migratory work force. His analysis, however, illustrates that the introduction of capitalist forms of labor organization (e.g. wage labor) did not replace forms of aviamento and subsistence production—more traditional economic systems in Amazonia. In contemporary Amazonia, he argues, all of these economic modes exist in concert with one another, and that a single person over the course of the year may work within these three spheres. From his fieldwork in western Maranhão and southern Pará Cleary (1993: 341) writes: "It was not difficult to find young men who in the course of a year combined working in agriculture on a family plot with Brazil nut gathering, informal

[76] Brazil's development policies since the 1970s encouraged both large and small-scale agriculture in the region and thereby laid the foundation for a divided agrarian class in the Amazon. The policies provided fodder for the land disputes between small farmers in the Amazon and ranchers that often ended in murders and violence in the region (Hecht and Cockburn 1990). Government support for cattle ranching strengthened ranchers' political and economic power in Amazonia; at the same time, however, land resettlement programs under the direction of the federal government (the National Institute of Colonization and Agrarian Reform-INCRA) relocated a poor class to the Amazon with little political and economic power. Caboclos were excluded from these agricultural reform policies and in the process left in a vulnerable situation regarding land tenure.

sector mining and urban construction working, and in the process worked under a form of *aviamento*, for wages, for a percentage stake, and for themselves." Second, Cleary discusses the synergy between economic sectors in modern-day Amazonia. For instance, he recalls that for peasants in Maranhão, the acquisition of urban wages from mining allowed them to maintain a rural homestead, and in agreement with Nugent (1993) that subsistence production allowed caboclos to sustain themselves when wage earning opportunities waned in the cities. Finally as a third point, Cleary argues that while all peasant livelihoods are diverse, vast differences in the availability of natural resources and independent economic histories have created major discrepancies in economic potential from region to region, or even within regions. Thus, they ways in which individual households combine specific economic activities vary widely across Amazonia depending upon the different opportunities available in the locale. For instance, he says, "On the coast of Pará and Maranhão the basis of *caboclo* economy is fishing, in Acre it is rubber tapping, in Roraima it is even ranching (335)." For this reason, Cleary argues that it is impossible to speak of a single peasantry united around one activity; the defining feature of the Amazonian caboclo peasantry is rather their diversity.

Theoretical contributions of later ethnographies: Caboclo Agency

While early ethnographers argued that socio-economic patterns were largely a product of macro-level forces, namely environmental limitations and external market pressures, Nugent and Cleary's essays suggest that caboclos not only respond to external conditions but directly intervene in the making of those circumstances (Nugent 1993, Harris 2000b). Both Nugent and Cleary describe caboclo mobility as an active form of livelihood construction, where caboclos choose to migrate sometimes over great distances in search

of employment opportunities. In his recent ethnography on the floodplain community of Parú, state of Pará, Brazil, Harris (2000b) expands upon the notion of caboclo agency first introduced by these authors and presents an alternative way of understanding caboclos' relationship to the environment and to larger economic systems. Harris begins his critical analysis by arguing against theories of adaptation present in early studies on caboclo societies in Amazonia (c.f. Wagley 1954, Moran 1974). Harris argues that the adaptation theory does not sufficiently explain the human-environment relationships he observed in Parú. Harris argues that far from being restricted by the environment, residents have long taken an active approach, and when necessary have intervened using their own technologies to overcome environmental limitations.[77] In addition, Harris argues against the idea of cultural knowledge as static; whereas Wagely and Moran described Amerindian culture as a "blueprint" dictating patterns of natural resource management, Harris argues that these technologies are constantly changing. He says that while previous experiences to some degree inform decisions regarding the use of natural resources, caboclos thus make in the moment decisions based upon current environmental conditions. For example, while working from a base of knowledge, farmers continuously adjust agricultural techniques to match annual changes in soils geomorphologic conditions. For this reason, Harris argues natural resource management for caboclos is best understood as an ongoing learning process through trial and error.

Harris (2000b) further expands upon the idea of caboclo agency in his discussion of the regional economy in Parú that has been characterized by boom and bust cycles for forest and agricultural products. Harris argues that even though caboclos have long been

[77] As an example, Harris describes how caboclos enrich soils to make them more conducive to production.

integrated into these external markets, these forces have not entirely *dictated* their work patterns. Instead Harris believes that the nature of extractive work, conducted away from the control of an employer and in the isolation of the region, has provided caboclos with the freedom to decide how much time to dedicate to market activities. By maintaining a livelihood that integrates a myriad of informal and opportunistic economic relationships (such as dealing with itinerant traders or directing production to informal urban market demands) and subsistence activities, caboclos are not dependent on the market for survival (this argument was also made in Weinstein 1985 and in Nugent 1993). Harris also argues that the economic history of the region, characterized by periodic integration into the world economy, has forced caboclos to be self-dependent and sustain themselves during times of weak external demands. This history thus encourages livelihood diversification and traits of recoverability, changeability, flexibility and opportunism. In sum he argues that to keep abreast with changes in the environment and differences in the availability of resources (fish, game, land suitable for agriculture) and economic opportunities (access to economic markets and wage labor), residents rely on continual improvisation and innovation, and as such people "draw on old ideas and relationships to make them 'relevant in the moment (Harris 2000b:19)."

Discussion and Conclusions

The caboclo peasantry in Amazonia, like all postcolonial societies, is a "reconstituted"[78] peasantry that came into being in the wreck of Portuguese colonialism, an era characterized by violence and disease. The years following the retreat of the Portuguese were characterized by social and economic chaos and more violence in the years leading

[78] The idea of a reconstituted peasantry follows Mintz (1974) who first applied the concept to Caribbean peasantries.

up to Brazilian independence from Portugal. To survive, the new peasant class used all available resources of the heterogeneous environment and ideas from various cultures (European, African, and Amerindian) to create a new culture. In a region that lacked a formal economic structure, caboclos adopted a peasant lifestyle, selling forest products to fluvial traders and engaging in subsistence practices, largely rooted in the traditions of diverse Amerindian groups. With the onset of the rubber boom, caboclos were integrated into the trade; the dynamics of aviamento encouraged Indians and new migrants often sent to far flung corners of the region to adopt the caboclo mixed production model.

When Wagley and his team of researchers landed in Amazonia, the peak years of rubber collecting had passed. In eastern Amazonia, he observed that residents maintained a production system based on both the production of manioc in the terra firme and the collection of forest products in the várzea lowlands; residents were involved in weak aviamento relationships, generally trading with a local patrão. Wagley's ethnography, along with studies later conducted by Emilio Moran, provided ethnographic data that shed light on resource management patterns by caboclos, a group that had yet to be studied in Amazonia despite their importance to social patterns in Amazonia since the 1800s. Consistent with the work in anthropology at the time, Moran and Wagely stressed the rural nature of caboclo economic strategies, and argued that these patterns were derived from the environment in which the groups lived. Years later, Ross (1978) discussed the role of external economic forces in shaping the condition of the peasantry. He concluded that local economic patterns and caboclos' condition of poverty were largely the result of external market forces within which caboclos were mere pawns.

Thus, these early ethnographies largely concluded that caboclo societies and patterns of resource management were the results of external forces.

Moving from the early ethnographies to more modern day accounts of life in Amazonia, we observe a trend toward greater livelihood complexity. The modernization schemes since the late 1970s gave way to new urban centers and the rise of the informal economy in these centers. Researchers who studied caboclo groups in this modern era found that caboclos livelihoods have become even more complex and diverse. Caboclos integrated urban wage labor and service work into a rural-based livelihood system and in the process expanded the geographic extent of their production locale. In addition, caboclos began to work under various work regimes, including forms of aviamento, as wage laborers in capitalist projects and as subsistence producers. In these later ethnographies we see a new vision of caboclos as actively seeking out opportunities (as opposed to accommodating simply what the environment or formal economy offers) and in control of their work patterns.

The challenge of writing about the caboclos is that in reality the group is not defined by their unity, but rather by their diversity. Across Amazonia, patterns of resource management vary considerably. However, reflecting upon the caboclo literature, it is possible to identify a few core characteristics attributed to their economic strategies described by all researchers studying these groups. Throughout history, caboclos have displayed traits of adaptability and opportunism as they continually reinvent themselves to keep abreast of environmental, economic, and social changes. In addition, caboclos

have used mobility to increase their livelihood options and over time the radius within which they work has increased.

In spite of the argument that livelihoods are continually changing, if we examine the structure of livelihoods (up to this point in the literature) we see that it has remained constant. To acquire outside urban goods, caboclos either engage with markets or participate in wage labor. These activities are complemented with subsistence activities that have increased livelihood security and caboclos' independence from external market forces. When the last ethnography was completed in the 1993, we see that even though caboclos integrate urban work into their production regimes, at the core their livelihood systems are rural in nature, and that in the interior, modern forms of organizing labor are rare; rather, forms of aviamento, bartering, and subsistence production are most important to household survival.

Chapter Five builds upon this literature review and outlines the history of two caboclo communities in Amapá, an area where social life has been particularly influenced by African slaves brought to the region to support colonial projects in the 17th century. The discussion concentrates on changes in main economic activities and natural resource management strategies in the study area and addresses the question of how these patterns observed in the study compare to the conclusions derived from the literature review.

CHAPTER FIVE: Settlement and Economic History of Carvão and Mutuacá, Brazil

Introduction

Building on the background literature provided in Chapter Four, this chapter describes the history of Carvão and Mutuacá from the settlement of the communities in the late 1800s to the present. In keeping with the greater objectives of this dissertation, the discussion focuses on changes in the management of plants and other natural resources and shifts in livelihoods throughout history. The intent of this chapter is to provide a lens through which current observations of livelihood transitions and urbanization processes in Carvão and Mutuacá can be understood.

According to the local history, the Carvão-Mutuacá region was settled in the late 1800s by African slaves. By the 1970s, the two communities would come to be recognized as separate places distinguished by distinct production patterns. However, since the region was settled, residents have moved freely between the adjacent environmental zones. For this reason, the history of the study site is told as a single story and throughout the discussion, I identify the distinct processes occurring in each locale at different moments in time. The history of the community can largely be broken down into three different periods: settlement and early history under aviamento relations. A period of transition from the late 1960s to the 1980s when social and economic relations were diversifying; and a more recent period since the mid-1980s characterized by the restructuring of land and social relations that have greatly impacted natural resource management patterns in the study locale. Consistent with the larger literature, caboclos in the Carvão-Mutuacá region have participated in a great diversity of economic activities

including (among others) the collection of wild rubber, seeds, the management and extraction of commercial timber species, the production of farinha, açaí and other tropical fruits, and the collection of freshwater shrimp. In line with the larger literature on caboclos, residents in the study site have worked under different labor regimes. Until the 1960s, residents were involved in aviamento trade relations; afterward they worked independently or semi-independently, selling goods to individual consumers or to contracted buyers.

Throughout history, residents have relied upon the core characteristics attributed to the Amazonian caboclo, including adaptability, flexibility, and opportunism, all of which have allowed caboclos in Carvão and Mutuacá to survive in a region characterized by environmental and economic uncertainty. While these conclusions are consistent with the larger literature on caboclos, the history of the community provides a unique portrayal of caboclos, who largely belong to a sub-group of Afro-Brazilians in Amazonia. The history shows that despite residents' inferior social position within the larger society as caboclos and as African-descended peoples, over time residents have displayed an active sense of agency. In contrast to the larger literature on caboclos, residents have used direct forms of social activism and political organizing to increase economic opportunities and to improve social conditions, and thus despite major obstacles have largely been in control of their own destinies.

Settlement and Early History of Mazagão, Amapá (1760-1920)

European colonization of the municipality of Mazagão began in the late 1700s, at a time when the Portuguese Crown was fighting to maintain its control over its northernmost Amazonian territories. Throughout the colonial period, the territory of Amapá (which at the time belonged to the colonial state, Grão-Pará, a region that includes the modern Brazilian states of Pará and Amapá) was the site of ongoing border disputes between the French, English, Dutch, Spanish and Portuguese. To maintain power over the region, the Portuguese sought to establish a military presence in the north, and built number of forts at the mouth of the river to prevent westward intrusion into the interior. The last in the series was the famous *Forteleza de Sao José de Macapá,* built by slaves and Indians from 1764 to 1769 and which still stands at the foot of the city today. The Crown was also eager to populate the region with Portuguese citizens as an additional measure of security. In particular, the colonial government dispatched officials to locate a potential site to build a colony to house residents of a recently evacuated Portuguese colony located in North Africa, an area that today corresponds to Morocco (Mazagão in Morocco rested 90 kilometers from Casablanca. Today, the city in the same location is named El Jadida). The new Mazagão in Amazonia, *Nova Mazagão,*[79] was to serve three purposes: to house the refugees of the fallen settlement in Morocco; to serve an auxiliary support role to the military guarding the mouth of the Amazon, and to produce rice and cotton to help fund colonial projects in Amazonia. Nova Mazagão is important to the history of Carvão and Mutuacá, as these communities were off-shoot settlements of the original colony (Muniz 1916).

[79] Until 1915, Nova Mazagão was the administrative seat (*sede*) of the region. After this date, the sede was moved to its current location in Mazagão Novo. When authorities relocated the *sede,* Nova Mazagão was was renamed Mazagão Velho (Morais et al. 2003).

Mazagão in Africa

The original African Mazagão colony was founded in 1513. The city, in actuality a large fortress surrounded by a plaza and headed by an ornate church, was built during the early days of Portuguese colonialism to support nautical voyages from Europe to India along the *Rota de Cabo.* At its height, the Portuguese Empire was global in its extent. By the 1700s, however, the Crown had abandoned many of its projects to focus on economic development in the Brazilian colony. Portuguese neglect in its North African provinces left Mazagão, one of the last holdouts of the Portuguese, vulnerable to attack. In 1768, the Moors seeking control in the region invaded the plaza and nearly succeeded in crushing the city. The Portuguese Crown, no longer interested in investing resources in the region, declared defeat, relinquished control in the region, and evacuated 340 families from the fallen colony. The families, their slaves, and objects of value traveled to Lisbon, where they waited for two years while a new village in Amapá was prepared for their arrival. Of the original 340 families, only 168 would make the final journey to Brazil (Muniz 1916).

Meanwhile, during this same year, in 1769, scouts in Amapá located the north bank of the Mazagão River (at the time called the Mutuacá River) as a potential place to build the new colony. Based on the recommendations of the Italian engineer Domingos Samuceti, the land was leveled, and on September 23, 1771, a large team of over 200 men (122 of whom were Indian slaves) began construction on the church and village

houses.[80] The new *vila* was arranged along three streets running parallel to the Mazagão River, which at the time was reported to be so wide that large ships bringing construction materials docked at the foot of the city. Today however, this once grand river is a small stream (*igarapé*).[81] At the beginning of 1772, the first seven families were brought to Nova Mazagão, and by the end of 1772, 459 people (179 women; 203 men), a total of 89 families were living in the colony. By the end of 1775, a total of 163 families and their slaves were living in the colony (Muniz 1916).

The New Amazonian Mazagão

Due to its relatively remote location, the colony was not particularly useful in increasing security in the region. The colony did, however, become an important center for rice and cotton production. In 1778, 16,136 *alqueires*[82] of rice were exported from the Macapá region, with farmers in Mazagão producing 3,317*alqueires*. The colony's success in cultivation came to a halt in 1781 when an epidemic of an unknown nature hit the colony. Despite official efforts to quell the disease, many colonists died over the course of the year. After this deadly year, agricultural activity resumed; cultivation was however limited to cotton, and production never reached the levels of earlier years (Muniz 1916).

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[80] The houses were first constructed with a combination of mud and thatch (*taipa* and *palha*). When the governor of Grão-Para and Maranhão later visited the colony in 1775, he ordered that the houses be covered with clay tiles, which was considered more respectable (Muniz 1916).

[81] At the site of the *vila* of Mazagão Velho, the river today is a small stream, which dries up daily during low tide, and where even small passenger boats are often caught and trapped in the mud. Residents explain the narrowing of the river in two different ways. One account involves a corrupt priest who stole diamonds, the eyes of a precious saint and enraged the villagers who threw him out of the community. Residents say that the priest claimed he was wrongfully accused and was so angry at the villagers that he cast a spell on the river; the priest deemed that the "day would arrive when the river would be so narrow that even a chicken could cross the water." Other residents say that during the Cabanagem revolution Portuguese loyalists dumped logs and debris into the river to prevent an attack of the *cabanos* via the river, and that over time, the debris collected sediments, which led to the narrowing of the river.

[82] One alqueire is equivalent to 30 kilos or about 66 pounds (Wagley 1954).

Colonial reports of the construction and early history of Nova Mazagão are quite detailed. Within 20 years, however, reports coming from the region declined dramatically (Muniz 1916). This period coincides with the general retreat of the Portuguese from Amazonia (after the failure of the Directorate Act), and the fall of exports from the region. The years following Portuguese retreat from Amazonia and, leading up to Brazilian independence, were marked with chaos in the Mazagão region. According to oral histories from the region when the colony began to fall after the epidemic, Portuguese-descended families migrated from Nova Mazagão to larger regional cities, and those who remained were slave families—a fact that explains why Mazagão Velho today is primarily inhabited by African-descended peoples. While it is impossible to know exactly why slave families remained in region, it is possible that the isolation of the region provided families protection from their status as slaves. In the forests of Mazagão, slaves were free from immediate control and likely adapted the peasant lifestyle of the caboclos and Amerindians already living in the region. These refugees were also likely in contact with other African-descended groups living in escaped slave settlements (known as *quilombos*) throughout the region.[83] Even though slavery was not abolished until the 1888 in Brazil, the retreat of the Portuguese at the end of the 1700s and low population density of the area makes it possible to imagine that by "keeping a low profile" these groups were able to maintain their freedom from immediate control until emancipation. As will be seen in the history of Carvão and Mutuacá, the African-descended families

[83] Amapá and the Guianas to the north were the sites of many escaped slave settlements formed by refugees from plantations in Para and Maranhão, Brazil. Throughout the greater Macapá region, many *quilombo* settlements were established during the colonial years. Portuguese settlers came across these settlements during Indian slave raids. Colonial records report the discovery of a quilombo in the late 1700s not far from Nova Mazagão along the Anauerapucu River (also known as the Rio Vila Nova). Curiau is perhaps the most well-known quilombo in Amapá today; located on the outskirts of Macapá, the community was settled by slaves brought to the region to work on the *Forteleza de São Jose* (Muniz 1916).

originally brought to the region as slaves to support colonial projects would play an important role in influencing social and cultural patterns throughout the region.[84]

Early settlement of Carvão and Mutuacá

Era no tempo de escravidão quando o Carvão foi batizado…[85]

(Carvão was named during the time of slavery…)

While multiple variations of the origin story circulate throughout Carvão and Mutuacá, residents agree that two upland areas, both of which border the várzea lowlands of the Mutuacá River, were settled by "blacks" (*negros*) from Nova Mazagão sometime during the late 1800s. Residents also agree that original inhabitants were members of Luz and Carmo families who were among the original slave families brought by the Portuguese to Nova Mazagão (Ramos 1995). The story of the Luz family is best told by Dona Maria da Luz, one of the oldest living people originally from Carvão.[86]As the story goes, Maria's great-great-grandfather, Antonio da Luz had recently married in Mazagão Velho; he and his wife were looking for a place to cultivate manioc and to build a home and a *casa de farinha* (or *retiro*). Because the area around the village of Mazagão Velho had become too crowded, the couple ventured further to the uplands surrounding the community. Antonio and his wife came across a large area of savanna, which today rests on the left side of First Street upon entering Carvão. Antonio looked over the savanna and deep in the bottom of a depression, he stumbled upon a shining and lustrous stone that resembled

[84] Today, the history of Nova Mazagão is reenacted in an annual religious festival where São Tiago, a saint who allegedly helped the Portuguese in their battles against the Moors, is honored with processions and community prayers; villagers also reenact the Moors and the Christians in colonial Morocco.
[85] Dona Maria da Luz , Fazendinha
[86] Dona Maria da Luz was born in Carvão in the early 1920s and left the vila with her father when she was fourteen years old. After leaving Carvão, she lived in various interior communities before marrying and settling in the outskirts of Macapá.

charcoal. Finding the stone quite beautiful he said "Do you know what I am going to do? I am going to name this place "Carvão." And at the site of the stone, he and his wife established their *retiro*[87] and built their home. Eventually the couple gathered family members from Mazagão Velho and formed a small vila in the terra firme forest near Antonio's retiro. Dona Maria says that growing up, her relatives claimed that Antonio da Luz fathered twenty-five children, and in this way, the settlement began to accumulate residents.[88] The original inhabitants of Carvão lived in an area of upland forest near the campo, which quickly descends into the lowlands of the igarapé de Mutuacá that meanders to the Mutuacá River (and eventually to the main channel of the Amazon River). In the stretch of land near the old port, early inhabitants dug out a cemetery and planted various fruit trees, including mango trees. What remains in Carvão of the original early vila are these old twisting mango trees. Carvão residents today refer to the area as the *mangal,* the mango orchard, and consider the site sacred—an area upon which newcomers are prohibited from building. Over time, residents have found other material relics of the previous inhabitants including old house remains, ceramic jugs, and water cisterns. Perhaps because the area is rich in history and mythology, many residents today are intimidated by the mangal, and told me that only those who are courageous linger in the area of the old port of Carvão. Some residents claim greedy people are summoned to the locale and presented with large riches and those who are tempted grab the riches are pulled into an underworld, the space somewhere between this world and the afterlife.

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[87] A *retiro* is the regional term that describes a simple hut where bitter manioc root is processed into manioc flour. Residents use the word *retiro* interchangeably with *casa de farinha* (house of manioc flour).
[88] Dona Bene who lives in Carvão today and married into the Luz family says that her late husband, Dona Maria da Luz's nephew, explained that Carvão was settled by four *Africanos* (Africans) – two brothers and two sisters who married one another – and recalls that one of these women had twelve children all by herself.

After the Luz family settled in the mangal, the Carmo family, also from Mazagão Velho, settled along a separate upland bank of the Mutuacá River at a distance of roughly two kilometers from port of Carvão (the mangal).[89] Specific details as to how and why the original inhabitants settled here are unknown. However, this area, which is the port entryway to the Mutuacá River, shortly afterward came to be called the Queimada, as the original inhabitants settled in the area of a previous clearing (perhaps for agriculture). Sr. Raimundo Nonato do Carmo, who still lives in the Queimada and is the oldest member of the Carmo family (both in Mazagão Velho and Carvão), says that as a child he knew that his family was originally from Mazagão Velho. He spent the month of July in Mazagão Velho visiting relatives and participating in the religious festivities of São Tiago. At the same time, however, he did not know why his grandparents originally settled in the Queimada, and explained that in those days children did not ask as many questions and his relatives did not offer details (the way in which Dona Maria's father commonly recounted the tale of Antonio da Luz). By the mid-1930s when Sr. Nonato was a young child, he remembers that there were about 25 homes between the two settlements. Even though there was a distance of two kilometers, the two groups were in continual contact with one another.[90]Residents from Carvão would either paddle their canoes through the forest along the igarapé, or would walk along a footpath that passed through both areas of savanna and upland forest. In the area of the current day vila of Carvão, there was an island of terra firme forest surrounded by two large savannas; the farthest one away being

[89] The area of the mangal is also the old port of Carvão. During the early days residents launched canoes from this locale to access the várzea of the Foz de Mazagão. Today, however, the port is rarely used and the Queimada has become the public entrance.

[90] From the beginning, the Luz family sponsored the religious party Festa de Piedade, where the Catholic Saint Piedade is honored in the style of caboclos and African-descended peoples in Amazonia. Likewise, the Carmo family has long sponsored a party to honor Nossa Senhora de Conceição.

called the *campo de fora*, and the nearby forest, the *campo de dentro*. Today the vila exists in this location and residents say that the *taberebá* (*Spondias monbin*) trees that grow in villagers' home gardens are the last of what remains of the forest island that once existed in this locale.

Early Economic Activities, Carvão and Mutuacá (1920-1960)
Forest collection and aviamento *relations*

Existia um grande comércio na boca de Mazagão…a nossa vida era mais lá naquele tempo…[91]

(There was a large trading post in the mouth of the Mazagão River…During that time, our life centered most there…during that time…)

Eu me nascei na estrada cortando seringa…foi uma coisa que gostei muito…na madrugada eu ficava na mata de baixo das seringueiras e era só eu com Deus…[92]

(I was born on the rubber trails…It was a thing I loved…at dawn I was in the forest under the rubber trees alone with God…)

When Dona Maria da Luz described the origin tale of Carvão, she stressed that Antonio da Luz came to the area during the time of slavery and that he and his wife were slaves. Based on rough calculations, Antonio da Luz and his wife would have settled in the area of the stone in the late 1800s, around the same time that slavery was abolished—which

[91] Sr. Roberto, Rio Mutuacá.
[92] Dona Leandra, Rio Espinhel.

took place in 1888.[93] At the time Carvão was settled, the nearby várzea areas were being extensively explored for wild rubber to send to regional cities for export. Settlement occurred during the middle of the boom period that roughly lasted from 1850 to 1920 in Brazil. While we know little of the exact details of how the original inhabitants of the mangal and the Queimada lived, from the oldest living residents in Carvão and Mutuacá, we can obtain a sense of how people survived from late 1920s to the early 1930s. Most residents with memory of these years tell tales of collecting rubber on estradas in Mutuacá and through the Foz de Mazagão during the summer months. Tappers gathered wild rubber from up to 150 trees daily, setting out in the forest before dawn and returning to their residences before noon. Until the 1960s, residents gathered together large quantities of latex and later transformed the liquid into congealed pellets (*balões* or *balão*, singular) in a process that involved smoking latex over burning urocori seeds (*Attalea excelsa*) a common palm found in the Amazon estuary.[94] Rubber was processed in the late mornings when tappers returned from the forest. During the winter when the collection of natural rubber was more difficult because of the heavy rains, Sr. Nonato and other elderly residents in the region recall collecting the seeds of *andiroba* (*Carapa guianensis*), *murumurú* (*Astroçaryum murumuru*) and *pracaxi* (*Parkia* sp.), all of which were valued for their oils that served as fuels for lighting and as an ingredient in soaps

[93] In other versions of the story, Carvão residents say that the community rests at the site of an old *quilombo*, an old refuge site first settled by slaves escaping bondage. Dona Maria told me that according to her understanding of the tale, her great-great grandfather came to the area of the campo in pursuit of land to grow manioc, and not to escape bondage. From local accounts by elderly residents, the black population in Amazonia faced daily discrimination and was oppressed by the wider society. However, as argued, given the retreat of the Portuguese in the early 1800s and the isolation of the region, to some degree slaves were likely able to maintain an autonomous (albeit hidden) peasant lifestyle.

[94] Most ex-rubber tappers from Mazagão report that processing latex was the most taxing part of the process. Many of these residents have poor eye sight and indicate the toxic smoke as the primary cause of their blindness (or near blindness).

and perfumes (Pinedo-Vasquez et al. 2002). On a much smaller scale, residents recall trading game, fish, and plant materials such as the root *timbó* (*Lonchocarpus urucum)* used in traditional fishing practices (Ross 1978).

While aviamento trade relations were weakening in many areas in Amazonia, elderly residents who have long resided in the Carvão-Mutuacá area report that merchant-client relationships dominated the regional economy until the 1960s. Residents in Mutuacá and Carvão traded forest products at a local trading post (*comércio*), which was allegedly constructed in 1917 and operated for over 50 years in the mouth of the Mazagão River near Mutuacá. The comércio is described as a "beautiful" building so large that it had 25 windows[95] facing the mouth of the river; and it addition to the store, a small vila that consisted of a prayer meeting house (*capela*) and a small schoolstretched along the waterfront.[96] The comércio sold essential goods—coffee beans, sugar, farinha, agricultural tools, and cloth for making clothing. A local woman even baked and sold bread each day to clients. Sr. Roberto, who was born on the coast of the Amazon River near the Mazagão and moved to Mutuacá as a young child, recalls that the trading post was owned by a Portuguese man, Montero da Silva, from the city of Belém. Silva owned much of the land in the area of the Foz, including sections along the Mutuacá River. The trading post was operated by various middlemen (*patrões* or *patrão*, singular) who supervised production on the lands, and were responsible for recruiting workers to tap rubber along the estradas in the forest. Today, most Carvão and Mutuacá residents

[95] This detail was reiterated in all of the oral history interviews conducted as a way to convey the "great" size of the trading post.
[96] As early as 1935, the school was teaching the primary grades one through four. Classes began in the afternoons and children canoed from their homes along the river to attend lessons. The first teacher in the Foz de Mazagão was from the city of Forteleza in the state of Ceará, Brazil and the second from Mazagão Velho.

remember the last of the patrões, a man by the name of Marquelinho Mutinho,[97] also from Belém. Sr. Roberto says that when he was growing up in the Foz de Mazagão, 160 clients (*frêques*) and their families lived on Montero da Silva's land along the Mutuacá and Mazagão Rivers. All of Silva's clients were required to trade with the patrão at the mouth of the river. Some clients like Sr. Nonato and Dona Maria's families had access to their own lands (that were passed down through inheritance), but also rented estradas from the patrão. They were required to trade their rubber at the post, but could sell other products elsewhere. Most, however, traded at Silva's comércio as this store was the closest place to market products.

Early subsistence patterns

Antes era melhor…a gente não tinha que comprar quase nada…eu nao sei sobre o resto, mas nós nos viviamos pela natureza…[98]

(The old days were better…we bought very little…I can not tell you about the others, but we lived by way of nature…)

While participating in the export trade economy gave residents access to manufactured goods necessary to survive in the interior regions of Amazonia, in reality the extraction of forest products represented a small portion of the household economy. Residents combined the collection of diverse forest products with various subsistence activities, including fishing, hunting and várzea and terra firme agriculture. Dona Raimunda Sabral, who has lived most of her life in the Foz de Mazagão, explained that after she married,

[97] Carvão and Mutuacá residents often vary their pronunciation of the last name; sometimes it is pronounced Mossias and other time Mutinho—or when speaking about the family, "os Mutinhos."
[98] Dona Raimunda Sabral, Rio Mazagão.

she and her husband struggled to be self-sufficient, and to produce as much of their own food as possible through agriculture and extractive activities (*pela natureza*). She explained that because they gave priority to securing food, her children did not experience hunger the way many of their neighbors' children did (which is not to say it never happened). In Dona Raimunda's explanation of the early várzea livelihood system even if you were dedicated to subsistence activities, there were always objects that you needed or desired but could not produce on your own, and that these needs forced you to engage in market activities and so the household was sustained by both combining store-bought goods from the city with food and products you produced from the forest (*mata*).[99] Like Dona Raimunda's family, most households engaged in diversified subsistence activities though perhaps to varying degrees. Subsistence patterns like the extraction of forest products for trade followed a seasonal cycle. Cultivation in the várzea was timed with the rise and fall of the river channel that varies greatly over the course of the year. During the late summer, from November to December, small areas of forest (up to 0.5 ha) were cleared on the high areas of the várzea. Felled trees, brush and debris were later burned after a period of drying, and the fields sown with corn a month later on the eve of winter rains. After three months, mature ears of corn were harvested and other crops were planted, including perennial crops, *cará do indio*, various varieties of potatoes and annuals, such as, squash, beans, and watermelon. Fruit trees and palms were planted and managed in agroforestry systems, many of which are still planted today.

[99] Dona Raimunda thus reiterates the basic structure of the caboclo mode of production (and Gudeman and Rivera's [1994] model of peasant economies) through her own understanding. The idea of surviving by way of nature continually surfaces in residents' explanations of resource use and management over time.

Residents living in the Queimada and the mangal in Carvão with access to terra firme lands also cultivated manioc roots for the production of *farinha,* the primary carbohydrate of the Amazon diet (Ross 1978). The production of manioc added a significant margin of security to residents' lives. The cultivation of manioc in the várzea areas of the Foz de Mazagão is limited to the highest parts of the land (*tesoura*, *tesa,* or *restinga*) or to areas of scattered terra firme (islands) in the várzea forests; this ecology meant that várzea residents needed to purchase farinha from the comércio, and thus increased debts or lowered profits. In addition, Carvão residents continued to plant manioc root in the uplands during a time when many rural Amazonians, preoccupied with the collection of forest products, had discontinued the practice (Weinstein 1985). Sr. Nonato of Carvão and Dona Raimunda remember two regional shortages of farinha that are described today as "crises," times when the comércio also ran out of farinha, or when the farinha that did come arrived sour and/or moldy. Sr. Nonato remembers selling farinha off the stove as quickly as his family produced the flour. Dona Raimunda recalls paddling around the Foz from house to house looking for farinha to purchase, and that even when she reached the Queimada, Sr. Nonato and his relatives would not even sell her a single liter of farinha. Finally, while it is customary for each meal to include farinha, residents recall eating meat or fish accompanied by banana (and not feeling full).

In addition, residents recall that they also raised poultry and pigs, which complemented agricultural production. Corn was fed to chickens and ducks and pigs grazed on excess fruits cast away in home gardens, fallows, and managed forests.[100] Food

[100] In the várzea areas of Mazagão, residents traditionally raise pigs suited to the flooded environment. Caboclos consider these native pigs ideal because they need little care and are essentially raised "by

was also procured through fishing and hunting, however, extraction of animal protein was more difficult during the rainy season when rains caused the rivers and streams to rise above the riverbanks and the fish dispersed into the igarapés in the forest, and game was difficult to spot in the down-pouring rain. In earlier times, fish were caught by fencing off parts of rivers and streams and placing fish poisons made from the root of *timbó (Lonchocarpus urucu)* in the water.[101] The stunned fish were then gathered from the surface of the water and placed into baskets. Sr. Nonato remembers that fish were especially plentiful in the Espinhel River and that during the summer months, when fish populations swam in more confined spaces, residents collected baskets full of fish and sold them to the comércio. When, as an adolescent, Sr. Nonato worked for the Mutinho family in the comércio, he salted the excess fish in the summer sold by Mutinho's clients. He found it ironic that during the winter months residents bought back the same fish that they originally sold to the comércio at a higher price.

Just as fish were plentiful, game in the forest was much more abundant through the 1940s. Residents used various techniques to hunt game including paca, agouti (*cutia*), matamata, and armadillos (*tatu*).[102] Many tell tales of passively letting their dogs loose through the agricultural fields and fallows and forests to catch a meal. Dona Bene from

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nature." The pigs wander over the forests and home gardens feeding themselves. Pigs can be a source of strife between neighbors, as they trample and eat crops. In the old days, pigs were often isolated on islands between igarapés in the várzea forests.

[101] Because of its deleterious impact on fish stocks, the use of *timbó* and other fish poisons is now prohibited by IBAMA, the environmental regulatory agency for the Brazilian Amazon. Timbó contains the chemical compound rotenone, which is also traditionally used as an insecticide. Residents say that in the past use was restricted and despite the use of timbó, fish were much more plentiful in Mazagão. The use of European hook and line was also likely used. Today residents catch fish with large nets called *maladeira*. From the oral history of the region it is unclear when this practice began.

[102] Today most hunters use rifles to catch game. While residents described the types of game that they caught and liked to prepare and stressed the abundance of animals in the forests, it is unclear how many people owned their own guns for hunting. Some residents report the use of bows and arrow, however, the use of hunting dogs appears most frequently in oral histories.

Carvão says that when she moved to Carvão in the early1940s, securing food for her family was simple. She often worked days with her husband in the manioc field (with her children resting in a hammock beside the field). When she left to weed her fields, she also let her hunting dogs loose. By midday her dog would return with a paca or cutia in its mouth, and just like that she exclaimed, "Food would arrive at the foot of my door." Dona Bene and others from Carvão also describe the traditional practice of managing areas of savannas and lakes in the terra firme. During the late summer, around the same time that manioc fields were being prepared, residents would set fire to flooded upland areas. The grass and sedge vegetation would burn quickly and the "cleaned" areas were ideal for catching turtles, fish, and other animals living in this environment. In oral histories, many residents describe an incident when the seasonal fires became uncontained, burned through the campos that surrounded the villages, and left many charred animals in their paths. Because the population of Carvão was so small at the time, this precious meat decayed under the summer sun and was wasted on the ground.[103]

Ideas of poverty, understanding so the past

O passado ere melhor de um lado e pior de outro…[104]

(The old days were better in some ways and worse in others….)

In discussing the past, residents speak of a time of abundance when natural resources were much more plentiful, and finding food in the forests was "easy." Stories of abundance, however, are always told in contrast to tales of poverty. Residents say that on

[103] In describing the incident of the fire, people find the wasting of meat a great shame. This feeling is even stronger today, as game stocks have been depleted.
[104] Sr. Raimundo Nonato do Carmo, Carvão.

the one hand, the past was better because of the abundance of natural resources, but on the other hand, poverty was much greater. Through residents' stories of the past, I came to understand that for caboclos in Carvão and Mutuacá, poverty means to have few material items (urban manufactured goods) and to have limited means acquiring outside goods.[105] Residents tell various stories to convey a sense of their material poverty, many of which include methods of stretching provisions from *quinzenha* (market day) to *quinzenha*—such as cutting matches in half and adding seeds to coffee grounds to make them last. Sr. Nonato liked to tell stories about a woman who was so poor that she worked at home naked; and that when visitors arrived she would close the shutters quickly and hide within the house. During those days, Sr. Nonato recalls, that if you had two sets of clothing, one for working and one set for socializing, you were among the lucky. Dona Isadora from Mutuacá, who harbors no nostalgia for the past, recalls sleeping on the floor as a child on torn up pieces of clothing, and is grateful that her children have never had to experience this type of misery that people of her generation lived through.

The material poverty described by residents was to some degree guaranteed by the unequal trade relationship between the patrão and his clients. Forest products were undervalued and manufactured goods imported at inflated prices. During interviews about the past, residents conveyed different understandings of their experiences with aviamento. Sr. Roberto recalls the days of aviamento with nostalgia and says that the

[105] Caboclos' understanding of poverty also shows that within the greater society, nature, natural resources, and rural livelihoods were not valued; essentially, even those who did not suffer and had plenty of food to feed their families considered themselves and were considered poor. In essence, being a rural worker was the same as being poor.

days of the patrão were far better. Mutinho was a good patrão who was like a father, as long as you were a good, honest, and hard-working client. He says that life in the interior was much more organized; everybody was assigned a piece of land upon which to work, and if a neighbor encroached upon your land and stole your crops, the patrão would settle the dispute. On the fifteenth day (the quinzenha), market day, Mutinho greeted his clients with free tobacco and sugarcane liquor (*cachaça*) and during the July and August holidays he also threw community parties. Sr. Nonato, who also personally liked Mutinho, and even worked for a period of time as a "cashier" in the comércio, says that he is not nostalgic for aviamento—as the system was restrictive and difficult for caboclos, for the poor. The trading relationship impoverished the families, who did not have access to cash, and from time to time Mutinho liked to humiliate[106] his clients. Sr. Nonato recalls, "Sometimes you wanted to bring home a kilo of coffee and he would place a small quantity in the bag, and say, "here, you'll get just this much…," and then added as much debt as he pleased to your account. Other residents in the area also recall that the days of aviamento were characterized by continual debt (*a gente so ficava devendo*…) and uncertainty that you could be pulled from one location to another. Dona Maria de Jesus, for example, came to Mutuacá in the 1960s after living on five different properties controlled by separate landowners. She explained that her confrontational

[106] The verb to humiliate translates into the Portuguese *humilhar*, which like the English, also means to make a person feel humble, small, or poor. This meaning is especially relevant to understanding acts of contestation between the patrão and his client. Even though Mutinho was for the most part a good person, humiliating his clients helped to uphold the social order in the interior. In Sr. Roberto's case, he accepted these acts, as he also accepted his place as a poor person. To be poor and humble is considered dignified in traditional Amazonian society. Poor or humble folk today (*os humildes*) are compared to those who have recently risen in the social ladder and have "*pavalagem*" (think they are better than others). Educated, wealthier people (usually of urban origin) who are humble and can accept the caboclo standards are considered *pessoas simples* and are much more respected by the caboclos. People with pavalagem are generally disliked and avoided.

husband had difficulty appeasing his patrões, and because of his behavior they were often forced to leave their placements. Other residents discussed certain practical limitations of the aviamento system; many times the comércio did not have the items you desired. In these cases, you traded at night in secret to fluvial traders who entered the river and would bring items on request. Sr. Nonato said that the regatões would sometimes pay cash for your products, which you could then spend in the city on whatever object you desired. As McGrath (1999) argues, the regatão in Amazonia gave caboclos a concrete way to oppose and resist the patrão and created a breathing room in an otherwise restrictive environment. He was also a more neutral link to the outside urban world, not only bringing material goods from the outside world, but also news and stories of his travels.

Economic Activities, Mutuacá (1960-1988)

Throughout the 1960s, demand for wild rubber[107] and oil-producing seeds declined steadily, and the exploitation of timber replaced the extraction of non-timber forest products as the principal economic activity in the várzea areas of Mutuacá and Mazagão. Historical records estimate that seven foreign-owned sawmills and four international plywood factories operated in the Macapá region with a daily outputs of 20,000 m^3 and 22,000 m^3 respectively. Commercial efforts concentrated on the extraction of the following hardwood species: *cedro* (*Cedrela odorata*), *sumaúma* (*Ceiba pentandra*), *ucuuba* (*Virola surinanensis*), *muiratinga* (*Maquira coriacea*), *andiroba* (*Carapa guianensis*), and *mogno*; *Swietenia macrophylla* (Pinedo-Vasquez et al. 2001). The

[107] In the late 1950s, demand for "cured" rubber (in pellet form) declined and residents began to sell the liquid latex to the Mutinhos, to fluvial traders that entered the Foz de Mazagão Velho, and to urban buyers in the port city of Santana (residents remember in particular selling latex to Jose Valente who owned a large store in the waterfront of this port city).

várzea forests in the greater estuarine region were intensively harvested for a period of about 15 years; stands of these commercial species were largely depleted by the late 1970s and most large companies retreated from the region by the end of the decade.

The infiltration of the timber trade into the estuary brought about various changes for residents in Mutuacá, the first of which was the reordering of landholding patterns along the river. Residents recall that sometime during the late 1960s, Montero da Silva sold much of his land in Mutuacá to a timber company by the name of Madesia, which exploited the areas in and around the old rubber trails for commercial hardwood species. Sr. Roberto remembers that when Madesia entered the Foz, many families who had lived and worked on their lands for decades were forced to move elsewhere. The trading post was sold and a sawmill was mounted in its place. The story of the trading post seems strange because the comércio was at one point Silva's property.[108] Residents recall, however, that when Mutinho died, his heirs (a son, named Morcito, two daughters and their husbands) took over operations. Soon after "the old man" (*o velho*) Mutinho died, his daughters and their families moved back to Belém, and left Morcito alone to run the comércio. According to Sr. Nonato, Morcito drank day and night and became incapable of maintaining the business. Morcito sold his store for 30 *cruzeiros* (the Brazilian currency until the 1990s) to a man named to Osvaldo Colares who built a sawmill at the site of the old comércio. Meanwhile, Morcito moved across the river and built a small home (described as a sad little wood hut). Sr. Nonato and other former clients helped sustain Morcito with farinha, fish, and firewood until he too moved back to Belém. The

[108] It is possible that either Mutinho bought the post from Silva or Silva allowed the Mutinho family to keep the post after he sold his land. Because of cited changes, the comércio would have had difficulty maintaining itself and if it had succeeded would have operated under modified aviamento terms.

sawmill in the mouth of the Mazagão River was at some point named Mazaganete and operated in the mouth of the Mazagão River until the early 1980 under three different owners. Residents recall that Colares sold the mill first to a Cuban man by the name of Angelo, who then sold the establishment to Juan, an American from Miami. Because he is the most recent, today more residents talk about Juan. When Juan bought the sawmill from Angelo, he also purchased lands throughout the Foz de Mazagão including along the Mutuacá River. Residents are always impressed by his operations: he had a large boat, a tractor, large saws to cut logs into boards, exported entire trees and boards, employed up to 80 employees and had a nice home in the uplands of Carvão.

Oral histories from Carvão and Mutuacá indicate that caboclos from Mutuacá and Carvão were involved in various aspects of the timber trade. Residents extracted timber from várzea lands and sold them in a number of ways.[109] Sr. Roberto recalls the Dutch owned timber company Brumasa's boats entered the Foz to purchase virola, andiroba and muiratinga logs. Dona Joana Aruda from Carvão, whose husband worked for years extracting timber in Mutuacá, enthusiastically described the process of extracting timber. She recalls, "The trees in those days were so large in girth! I found it incredible that men could remove them from the forest." Men, she remembers, worked in groups of ten. First they would clear paths in the forest, and roll the enormous logs to the banks of the river and onto large rafts. In her memory, most sold their timber to the sawmill at the mouth of the river. Dona Maria de Jesus who lived along the Mutuacá River during the years of timber trade says that when her son was just 17 he would construct large rafts *(jangadas*)

[109] Some residents continued to receive goods in exchange for timber while others were paid directly in cash.

from 25 to 100 trees, and would float rafts to the city of Santana where the wood was purchased by one of the sawmill owners of a middleman. In addition to extracting and selling timber, some area residents worked as employees at the Mazaganete sawmill, operating the machinery that cut logs into plywood. During one interview, an informant listed 12 individuals who live in Carvão and Mutuacá today who were previously employed by the company. Finally, various residents from Mutuacá and the Foz de Mazagão worked for Brumasa, whose operations were spread widely throughout the region. In particular, one family worked on the company's timber plantations on the Ilha do Pará, planting rows of andiroba seedlings.

Most foreign-owned timber companies left the region by the early 1980s when commercial timber stocks were depleted. When the larger mills were closed down in the region, many local families who had learned both wood processing techniques and how to operate sawmill, established local sawmills. During this time, families pillaged abandoned mills for their hardware to incorporate into new mills. Local residents recall that when Mazaganete closed down in the mid-80s (a little later than many other foreign-owned sawmills) that Juan's former employees rummaged the abandoned site, stealing motors, hardware, and other objects. Family owned mills geared their timber operations to the production of a variety of species that were sold locally. In contrast to most of the international timber companies, smallholders not only extracted timber from the forests

but also managed regeneration in a sustainable agroforestry system (Pinedo-Vasquez et al. 2001).[110]

Finally, throughout the 1980s, families in the várzea combined timber production with the sale of açaí and freshwater shrimp also marketed locally. Local demand for these products grew with urban expansion. Residents combined this mixed extractive system with subsistence activities, varying production of commercial activities to meet market demands.

Community Building, Carvão (1968-1980)

While the histories of the communities of Mutuacá and Carvão have always been linked, the settlement and evolution of these spaces took place on independent trajectories. Sr. Nonato recalls that at one point when he was a young child (which would have been in the 1940s), the Luz family left the area of the mangal. He remembers that the area around the old port of Carvão was abandoned and all of the houses and the *casa de farinha* began to decay, and afterward the forest rose and reestablished itself in around the residents' old fruit trees. The reasons for the mass exodus remain unclear. Dona Maria da Luz was an adolescent when her family left Carvão, and recalls that her father simply tired of living in the vila. He went searching for other economic opportunities in the *castanhais* (Brazil nut groves) in the Jarí region of Amapá. Sr. Nonato believes that people left for areas cities to be closer to school and work opportunities.

[110] Despite the economic opportunities that the timber industry provided, residents involved in the extraction of timber are not nostalgic for the activity. The extraction of timber and the operation of sawmill machinery are dangerous and physically taxing activities, and many residents bear the physical scars of the trade; some were left permanently disabled from on-job injuries.

Carvão remained deserted until the 1960s when relatives of the Luz and Carmo families, such as the Perreira family, the Souza family, Santos and Barreto families, settled in separate areas of the present-day vila of Carvão. All of these families are of African descent and form the backbone of the social structure of Carvão today. During this time, the Serra and Pimental families, from the northeast of Brazil and the island of Afua respectively, also moved to Carvão. Families moved to the uplands for different reasons; many came from the várzea where opportunities in forest extraction were dwindling with the intention of planting manioc and selling farinha in Santana and Mazagão Novo. Other families moved to Carvão to be closer to schools and services that at that time were located in Mazagão Novo. As more people began to move back to Carvão, families joined together and began a series of community building projects to bring these services directly to their rural village.[111] Residents first carved out a small dirt road through the forest with axes and machetes; later, residents built a community center[112] where prayer groups were held by community members or by a local priest remembered today as "Padre Angelo."[113] After a time, the mayor of Mazagão took interest in the community, and helped secure funds to build a two-room school and a health post. After the school was built, the Catholic Church of Amapá also built a small church that became the new place of worship. During the early 1980s, the municipal

[111] While the exact dates are unknown, community building projects took place during the 1970s and were completed by the end of the decade.
[112] At some point during the late 1970s, a small store (*cantina*) operated from the back of the community center. The store closed within less than a year allegedly due to mismanagement and local corruption. Many residents were unwilling to talk about "what happened to the cantina" because they found the experience so disappointing and frustrating. After the first *cantina* fell, Sr. Nonato's mother reopened a new store run by the women of Carvão; this store also closed within a year.
[113] Padre Angelo traveled throughout the entire interior region of the state organizing communities into groups for religious study. In Carvão, Angelo is also credited with driving the first automobile, an old white jeep, through the vila.

government of Mazagão built a small *casa de farinha* for communal use. For most residents, the development of the vila that roughly occurred from 1970 until 1980 was "the" beginning of Carvão. However, Sr. Nonato and descendents of the Carmo and Luz families, and Sr. Roberto in particular, disagree, calling this period, "the second generation of Carvão," and are interested in understanding more about the time of the mangal and how their relatives lived.

During the 1970s, the *Instituto Nacional de Colonização e Reforma Agrária* (INCRA), Brazil's land reform agency also began redistributing land throughout the country. Some residents in Carvão took advantage of the opportunity and began the process of obtaining legal land tenure. Based on this system, one household could access up to 100 ha of land. Thus, from this point forward, there emerged three distinct land tenure arrangements in Carvão: (1) legally recognized tenure, where residents pay taxes on their lands; (2) informal tenure, where land is not legally owned, but recognized by the public as belonging to one farmer through continual use; and (3) a situation of land borrowing, where a neighbor or family member works on another's land. In the third case, the farmer owns only the crops that he plants of this land. The granting of secure tenure had the effect of fixing families to a piece of land, and provided a great deal of stability, especially for those who moved from the estuarine islands of Pará, where the system of aviamento strictly defined tenure arrangements.

Economic Activities, Carvão (1972-1987)

From 1972 through the late 1980s, the economy of Carvão centered on the sale of agricultural goods produced in the terra firme environments surrounding the community. Agriculture was dominated by the cultivation of manioc roots for the production of farinha and other manioc products, such as tapioca and tucupi. In addition, families also sold corn, beans, pineapples and occasionally other fruits from their home gardens. According to local residents, when the vila was first being formed, residents sold their products mainly in Mazagão Novo. Farmers either transported goods on a van that operated between Carvão, Mazagão Velho, and the municipal seat on Saturdays, or peddled overland to the city. Farmers sold their products at an impromptu market that formed along the banks of the Mazagão River in the front of the town. Other families, especially those with lands in Mutuacá and Santana, would canoe from the Foz de Mazagão to the port city of Santana. One Carvão residents recalls that when he was a child, his father Manoel Serra would row for eight days to reach Santana (and then eight days back). Farmers either sold their products directly to consumers or established trade relationships with a single buyer, often the owner of a local store. Reminiscent of aviamento, farmers called these buyers their patrões, and even though they were now paid cash for their products, farmers purchased goods from the patrões' store. Residents explained to me that even though they were not obligated to purchase from the owner, they did so to ensure the market relationship. One informant explained that they were not obligated to buy from the owner, but to do otherwise would be to betray the unspoken agreement that each person (the farmer and his buyer) helped one another.

The marketing of farm products became more formal after the government of Amapá established public agricultural fairs (*feira do produtor*) in the city of Macapá. The rural communities of Carvão, Mazagão Velho and Curiau, closest to the capital city (all of which are made up of people of African descent) were the first to benefit from the program. In the early days, farmers remember that they spread out their products over the ground; later after 1986, the government invested in infrastructure and established three marketplaces (sheltered pavilions) in the neighborhoods of Pacoval, Buritizal and Jardim in the capital city of Macapá, where farmers from across the interior of the state sold products every 15 days to consumers. From the beginning, the government established the feira as a holistic rural development strategy. Farmers would be able to sell their products directly to the consumers, cutting out the middleman, and would have transportation to the city and, thus, greater access to urban services. Carvão residents recall that after selling their products, they would purchase desired household or sometimes seek medical services. In the latter case, residents would often stay with urban relatives and then head back to Carvão the next day. The government also established prices for market goods, which, in theory, ensured that the farmer received a better share of the profits. In its early days, residents recall that sales were good. The urban demand for farm products exceeded rural production and in Macapá consumers preferred farinha from Carvão because of its fine quality. Even in these early days of the feira, however, the government pricing system was not respected, and farmers sold their goods at the "market" price, an informal price that rose and fell based on daily changes in supply and demand (and thus did not make the income that the government projected).

In addition, even though middlemen (called *atrevessadores*) were prohibited by state officials from buying up goods in quantity in the market (for less than the established price), these buyers always circulated within the market. Middlemen often times peruse that market during the early mornings in search of the best looking products, buy them up, and sell them outside the market in makeshift stands; other times, they turn around and sell them to grocery store owners with establishments throughout the city. Some farmers welcome the middleman's presence in the market, and believe he provides a great service. These farmers explain that because the middleman has the means to purchase in quantity, he saves the farmer time, and many times prevents farmers from returning to the interior with unsold goods. Other farmers despise the middleman and believe that his actions are unjust—that the middleman takes advantage of the farmers' labor to make a living—and and thus out of principal refuse to sell to middlemen.

When the public market was established, farmers in Carvão increased production, and many families were selling up to 10 sacks of farinha every fifteen days. Residents say that field sizes were much larger than they are today (which are on average 0.2 ha), measuring from 0.5 to 3 ha in area; per the system of manioc cultivation, farmers often maintained up to three areas at one time, and thus produced enough to meet their families' subsistence and consumption needs. When describing agricultural activities of the past, Sr. Nonato once told me: "From the extent of the *capoeiras* you can see that agriculture was much more advanced in Carvão."

Not only was agriculture more advanced, but the extent of production and the labor required to produce farinha also meant that families and neighbors needed to work

together to meet labor needs. Residents recall that labor needs were generally met by the nuclear family. However, to complete the more arduous tasks of clearing forest cover and processing manioc roots into farinha, families joined together and formed work parties (called working in *mutrião*). Within this system, the head of household would provide food for the party that would fell the forest; and the members of the party would work several days until all families had an area cleared for production. Many Carvão residents recall with nostalgia the great fun they had working in groups. Ana, who was a child in the 1980s when manioc production was at its peak, says that during the days leading up to the feira the whole community was quite busy, and that this type of productivity was quite beautiful. She especially misses the time when all of her siblings gathered in the retiro, sometimes until midnight, peeling manioc tubers, and helping her parents toast manioc flour.

Beyond manioc, other rural activities in Carvão

From the 1970s until the early 80s, residents in Carvão who had settled there permanently also participated in the várzea timber trade. Dona Joana Aruda, a female farmer from Carvão, explained that while men worked either at Mazagenete, or were occupied in the extraction of timber, women remained in Carvão taking care of the manioc fields. Men helped prepare the fields, after which women maintained the crops until harvest time. Often women would trade labor working together to complete the tasks of weeding, harvesting, and producing farinha.

During this time, families also used the várzea areas for subsistence hunting and fishing. Through the 1980s residents recall that fish and game stocks were plentiful, and

thus they were not dependent upon urban foodstuffs to maintain their families. In addition, families planted corn either in terra firme or várzea soils and used the harvests to feed chicken and ducks in home gardens. Families also gathered açaí from Mutuacá; during these days, even if people did not own land in Mutuacá, they would gather fruits from other people's land, and because palm trees were abundant, the "owners" did not complain. Later in the 1980s when açaí began to be marketed in regional cities, families managed their lands more intensively to facilitate the growth these trees and increase its abundance in the forests.

Social and Political Change, Carvão and Mutuacá (1988-2005)

By the 1980s, two distinct economic systems had become established in Carvão and Mutuacá. Like residents beforehand, families in both communities survived in part by engaging in commercial activities to acquire household goods and by provisioning food from the forests, streams, and savannas. In the várzea, caboclos in Mutuacá maintained a mixed production system based the extraction of timber, açaí, and shrimp, all of which were sold locally; residents combined these activities with subsistence fishing, hunting, and agriculture. In the terra firme of Carvão, farmers planted manioc and produced farinha for sale in regional markets, using the várzea lowlands for fishing, hunting and the collection of açaí fruits. The sale of agricultural and forest products was geared toward local urban markets in the cities of Mazagão Novo, Santana, and Macapá. Settlement patterns in both communities resembled the traditional Amazonia form, with a small number of families living in scattered clusters, and while there was likely diversity in how people engaged in rural activities, there was little socio-economic differentiation among rural producers. A series of political and social changes, which began in the late

1980s, transformed social and economic life in Carvão and Mutuacá, such that when I arrived in 2003 to begin research on natural resource management, I encountered a much more complex livelihood strategy. While the structure of livelihoods and what people do is described in more detail in Chapter Five, below I outline the social and political changes that have altered daily life in Carvão and Mutuacá within a relatively short period of time.

The settling of Carvão came at a time when aviamento relationships were weakening throughout Amazonia, and reflected the attempts of residents, many of whom had been old clients in the system of aviamento, to become more independent. To help form the community, many became involved with the Catholic Church, which was advancing both a religious and political mission. At the time the Catholic Church of Brazil had taken a political stance against the repressive authoritarian government of Brazil and had mobilized rural residents into political action across Amazonia.[114] Among other acts, church leaders encouraged caboclo peasants across Amazonia to become involved with the national rural workers union (*Sindicato de Trabalhadores Rurais*), which was both a legally sanctioned way to oppose local elites and the government, and beneficial to rural people who as members were eligible for social security and health benefits (Houtzager 2001).

The role of the church in helping create the Rural Workers Union of Amapá remains unclear. However, union leaders from Carvão say that they learned about politics

[114] At the time the church was teaching liberation theology, a form of prophetic Catholicism mixed with popular Marxism that taught residents to participate in the struggle for liberation from exploitation by the ruling classes, and that the struggle was the execution of God's plan.

through their involvement with the church (during the time of Padre Angelo). From the mid-1980s onward leaders from Carvão and Mutuacá travelled across the state drumming up membership and educating people about their rights as rural workers. In Amapá, as in other places in Amazonia, the union brought independent small farmers and peasants (caboclos) into a larger political system and shifted their identity from clients within the system of aviamento to rural workers, a category that included all peasants regardless of ethnicity. The rural workers union movement reached Amapá almost 20 years after its initiation in Brazil,[115] and thus when caboclos from Carvão and Mutuacá became unionized, members' rights and the system of distributing monetary benefits was well established. Since the union was founded in Amapá, new members were eligible for various rights and benefits, including compensation in case of accident and disability, maternity payments, pensions for family death or disability, and social security payments (retirement) for female workers over the age of 55 and for male workers over the age of 60 (Schwarzer 2000, INSS 2005). Those eligible for pensions were (and still are) entitled to one minimum salary, which during 2005 was R$300/month (US$136), and was raised in 2006 to R$350.[116] Even though the process of joining the union and thus receiving

[115] The rural workers union was established in 1963 with the passing of the rural worker's statue. Modification of the rural worker's statue after 1965 guaranteed rural workers members' rights to health care benefits and social security. The stature was part of the military dictatorship's attempt to modernize the agrarian sector, particularly in frontier areas of Brazil. The government also believed that bringing independent farmers into the state system (and thus into central control) would quell communist uprisings in the countryside, and would help disrupt traditional patterns of land tenure, which were viewed as backward and a threat to economic development. In addition to the rural workers union, new land regulating agencies, including INCRA and federal agricultural extension agencies were created to help modernize the agrarian sector. Shortly after its foundation, the rural workers union movement split into two factions: the first, the corporatist movement, saw the union as a way to deliver services to rural peoples; the second, the progressive movement sought radical agrarian reform in rural areas, and in later years was supported by the Catholic Church who opposed the repressive government and sought to bring about democracy (Houtzager 2001).

[116] The rural workers union does not finance these services but rather is the mediating body between rural workers and Brazil's National Institute of Social Security (INSS). In addition to informing rural residents

benefits is extremely bureaucratic, requiring approximately 18 official documents residents in Carvão and Mutuacá have been quite successful in obtaining pensions of all sorts (Bernardo Espinale, personal communication, 2005). The union movement thus resulted in an increase of monthly cash income in both Carvão and Mutuacá since the late 1980s. Unlike cash earned through the sale of forest and agricultural products, union benefits were earned from month to month and thus were a stable source of cash entering the community.

In addition to receiving benefits, union members also gained a working knowledge of new land tenure laws in Brazil. Residents became aware that many of the previous land transactions were unofficial, and that under the new land regulations many landowners had no legal claim to their properties. Understanding that Juan, the old owner of the Mazaganete, had purchased land unofficially, in the early 1990s Carvão residents organized the invasion of the *Ramal de Mirim,* a large tract of land that had remained unoccupied and unproductive since Juan's retreat from the area in the mid-1980s.[117] When Juan left the region, a local man by the name of Sr. Hélio became the caretaker (*caseiro*) of Juan's land in the Ramal de Mirim. For several years, Sr. Hélio worked on Juan's land planting manioc and other fruit trees. José, young man from Carvão instrumental in organizing the invasion, told me that before the invasion there were many people in the vila who were in need of land; and it seemed a shame that there was so

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of their working rights, the union collects, organizes, and sends all the required paperwork to the INSS, which later distributes payments to its beneficiaries.

[117] The occupation of land owned by larger land owners was one tactic commonly employed by activists involved in the rural workers union. The history and relevance of the movement in Carvão and Mutuacá are described below in greater detail.

much productive land not being put to use.[118] He recalled that a small group of organizers approached Sr. Hélio and told him to claim enough land for himself and for his sons. Using a tape measure, José and others from the vila, divided up the land into 10 ha segments, and residents claimed land on both sides of the road. Carvão residents now with tracts of land in Mirim went to INCRA and filed to obtain legal tenure of the property. The case is however still being processed by the local land courts. The actions of Carvão residents have set an example throughout the region, and in recent years, long time residents of Mutuacá have since invaded Juan's land in the várzea along the Mirim igarapé.

While the rural workers union movement in Amapá was initiated by local efforts, the second change that impacted socio-economic life in Carvão and Mutuacá took place on a national level. After over 20 years of authoritarian rule, Brazil returned to a democracy after 1983 and underwent a long process of political re-organization. The passing of the new constitution in 1998 effectively made the northern federal territories, including Amapá, states of the federation. The new constitution also called for the decentralization of the federal government and granted more judicial power and financial resources to the states and municipalities (Souza 1997). In ex-federal territories like Amapá this resulted in an increase in the number of public jobs, and approximately 25 state-funded jobs were made available to residents in Carvão and Mutuacá directly after 1988. In 1991, as part of the geo-political reorganization of the state of Amapá, and also due to continued political leadership of Carvão residents, Carvão was elevated to district status, a change that has

[118] Jose recalls the organizers knew the land had productive potential because the previous owner had planted a large manioc field, about 10 ha in area.

had a considerable economic effect on the population. Municipal social services jobs (e.g., health, education) were created in Carvão. Furthermore, the communities now receive annual, albeit limited, municipal funds to maintain public areas within the district. Some Carvão residents benefit from these funds by earning daily wages for maintaining public spaces. Finally, in the mid-90s, many residents in Carvão and Mutuacá began to receive welfare benefits from several federal social programs designed to reduce poverty and inequality in Brazil, areas explicitly addressed in the new constitution (Souza 1997).

The organization of the rural workers union movement in Amapá and decentralization in Brazil were concrete political changes that had tangible impacts, increasing income earning opportunities for Carvão and Mutuacá residents. These changes occurred against a backdrop of local population growth and the spatial expansion of the communities. Since the 1980s, both communities have grown steadily; however, the expansion of Carvão has been more pronounced with streets being added each year. The opening of the Ramal de Mirim remains a part of this larger phenomenon; population growth in the study area appears to be the result of local migration, as most new migrants are coming from other communities within the municipality.

The expansion of Carvão and Mutuacá is part of a larger trend of urbanization occurring within the greater Macapá region. Since the late 1980s, in part due to decentralization, which caused a temporary boom in the public sector and promoted investments in local infrastructure which facilitated growth, the region has grown by 5% a year, making Macapá one of the fastest growing cities in Brazil. As in other parts of Amazonia, migration to Amapá's cities is best described as a local process, where rural

peoples move to regional cities to work in the informal economy. These larger patterns of urbanization have had different effects on the study communities. On the one hand, it contributed the growth of the local population as wealthy urbanites purchased interior portions of land for investment and low-income urbanites moved to Mazagão to improve the quality of their lives; here you can "freely" access natural resources and obtain food from the forests, rivers and streams. Urbanization in Amapá has also strengthened local markets for staple foods produced in the interior, such as açaí, cupuaçu, and graviola, three of the regions' most popular fruits, and for cheap timber and plywood used in shanty town construction in the peripheral areas of the cities. Increased demand for these products, especially açaí, which in addition to a local demand now has national and international demand, has been particularly beneficial to várzea producers. While the consumption of farinha has increased in Amapá's cities, farmers in Carvão have not fared as well. Because state production could not meet increasing demands of growing urban areas, in 1994 the state began importing mechanized farinha, which is produced much more cheaply, and thus, farmers in Carvão have lost these markets and today find it more difficult to sell farinha in quantity in the state agricultural fairs.

In summary, the four political and social processes occurring since the late 1980s, namely, union organizing, land reform, decentralization, and urbanization, have had a number of effects on socio-economic life in Carvão and Mutuacá. The first three increased income earning opportunities for area residents and opened up access to land and natural resources. Urban expansion has changed the character of the communities, which are no longer small, closed rural communities, and has prompted shifts in markets for traditional goods. Market fluctuations have provided incentives for the production of

várzea products. At the same time, however, farmers in Carvão have lost markets for manioc products. As is evident in the local history, these changes come after a long history of socio-economic change in the region, which has partially been caused by shifts in external markets.

Discussion and Conclusions

Many parallels can be drawn between the social and economic history of Carvão and Mutuacá and the descriptions of caboclo livelihoods in the wider ethnographic literature. Until the 1970s, livelihoods in Carvão and Mutuacá closely resembled the typical caboclo mode of production described in the earlier literature by Moran (1974), Wagley (1954), Parker (1985) and Ross (1978). Residents survived by engaging in both market-based and subsistence activities. As is typical in Amazonia, residents marketed non-timber forest products, and funneled their production through a local patrão. Rural production technologies described in detail by elderly residents in Carvão and Mutuacá bear many similarities to those described in Wagley and Moran's ethnographies, and provide new ethnographic information. From residents' descriptions we learn for instance of the management strategies used in the upland savannas, a practice rarely mentioned in caboclo literature. In addition, the specific role of many of these activities in livelihoods also remains constant throughout the literature; fishing and hunting are largely viewed as subsistence activities, and just as Ross (1978) discusses, the production of manioc in Mutuacá is a fallback activity. At various times in the history of the region, when other industries dried up, residents resorted back to production of manioc to sustain their families.

The oldest reports of daily life in the Carvão-Mutuacá region date back to the early 1930s, a time when aviamento was the principal economic system. The description of daily life during this time in the Foz de Mazagão was similar to Wagley's depiction of economic life in Itá. In both cases, caboclos were drawn into trading relationships with a local patrão, and were "obligated" to trade at his store. However, in neither case did the patrões use excessive power to enforce the trading relationship (although there are various accounts of aviamento guards armed with rifles prevented clients from escaping the rubber fields (Euclides da Cunha cited in Wagley 1954).[119] In addition, in Mutuacá, the patrão did not entirely control the well-being of his clients. As Weinstein (1985) argues, by engaging in subsistence activities, caboclo families were not dependent on the patrão (and manufactured goods), and were to some degree sheltered from his direct exploitation. Moreover, even before land reform, land in the Carvão-Mutuacá area was not entirely controlled by large landowners. Caboclo families, the descendents of the Luz and Carmo clans, also controlled their own properties, and because the land was passed down through their families, and thus continually occupied, land was never seized by more powerful families. The history of the region has thus shown that despite residents' marginal positions as caboclos (and as African-descended peoples), residents in the Carvão-Mutuacá region have to a large extent been in control of their own destinies. As Harris (2000b) argues for caboclos in Parú (state of Pará), the demographics of the region, combined with continual access to natural resources, has long provided a breathing space for caboclo peasants within a regional society that largely oppresses them. Caboclos agency is particularly seen in their active involvement in the timber

[119] Wagley (1954) argues that when the price of *H. brasiliensis* latex fell after 1912, rubber barons lost absolute control in the region and the coercive debt-slavery system disintergrated.

industry since the late 1970s. While the timber industry was largely exploitative of both natural resources and to some degree residents' labor, caboclos in the Mutuacá-Carvão region embraced the new opportunities, and when the timber companies left, they incorporated skills and knowledge into their livelihood system. Descriptions of caboclos' active involvement in society complicate arguments made by earlier ethnographers who largely described the caboclo society as being shaped by larger outside forces and caboclos as mere pawns controlled and defined by external economic and environmental forces (Moran 1974, Ross 1978).

We absorb a fuller more complex sense of caboclo agency when considering the recent history of the communities, beginning with the founding of the current vila of Carvão. In light of these recent changes, we see that the history of the Carvão-Mutuacá region is one of active change, where over time residents gained a working knowledge of urban institutions and tapped into national social movements, which yielded tangible material changes (e.g. income generation and increased access to land and resources) and thereby modified their position of marginality, first as slaves and then as clients within aviamento, within the regional society. This history is at odds with depictions of forms of caboclo resistance in larger ethnographic literature. In the previous accounts, caboclo resistance against the patrão was limited to engaging in subsistence activities, selling to fluvial traders, or contaminating rubber balloons (with sand to increase weight) (McGrath 2000) and more sophisticated political organizing was not yet an option in the region. Most recently, Harris (2000b) has argued that in contrast to other peasant groups in Latin America, caboclos do not organize or identify on the basis of class. He argues that the Amazonian peasantry is too diverse in terms of trade and ethnicity for this type of

identification to take place. Instead, he says that in Parú, caboclos use forms of evasion and separation to resist domination from regional elites. Specifically, residents limit contract with the urban society and keep tight control of community lands, passing it down through their families. These indirect resistance tactics, he argues, have allowed caboclos to perpetuate life on their own terms. The history of Carvão and Mutuacá, however, give us an entirely different vision of caboclos. Recent events show us that residents have a sophisticated knowledge of the political system, which contrasts other depictions of caboclos, including Harris' descriptions of caboclos as reclusive and uncomfortable in the "outside" world. Also the histories show us that residents do indeed identify on the basis of class, as they have taken on the category of rural workers—a category broad enough to encompass the ethnic diversity in the region. In this way, despite many current residents' shared African ancestry, residents have joined a class-based movement, because it offers them the opportunity to improve their social condition.

As a final word, the method of using oral histories allowed me to describe residents' understandings of the past versus the present, their ideas on poverty, and various ideas, opinions, and attitudes surrounding the patrão and the system of aviamento. In discussing the past, residents lament the present-day movement toward natural resource scarcity, and yet welcome the positive changes in economic development that have occurred over the last twenty years. In describing the system of aviamento, some residents, like Sr. Roberto, longed for the days of the patrão when life in the interior was more orderly, as the patrão stood in for the absent government and maintained the

order in the interior.[120] Other residents, like Sr. Nonato, argue that as a client, one's freedom was inherently limited, and thus these disadvantages outweigh the benefits of order. These examples illustrate that residents have their own complicated understandings of their own experience; this fact is again demonstrative of their agency through time. The case study thus makes a valuable addition to the literature, as even in Harris' ethnography that advocates for caboclo agency, we hear little from people themselves, and have little sense of how they have grappled with their own experiences.

Since the Luz and Carmo families settled in the Carvão-Mutuacá region, residents have shifted major market-based activities from the petty extraction of wild rubber, oil-producing seeds, timber, shrimp, açaí, and the cultivation of manioc for farinha. In the process of these transitions, residents have worked as clients under the traditional system of aviamento and independently or semi-independently, selling products to individual consumers or through an informal contract system. While engaging with markets has given residents a means of obtaining manufactured goods, either directly or indirectly, they have also participated in a diversity of subsistence activities, using both the resources of the várzea and the terra firme. While major activities may have changed, livelihoods have remained rural in nature, and caboclos themselves have displayed the core characteristics of the caboclo. Residents are flexible and opportunistic, as they continually learn new skills and take on new trades in an ongoing process of self evolution, which allows them to embrace new economic opportunities. The recent social and economic changes beginning in the late 1980s have prompted residents to adapt to a

[120] Sr. Roberto's stories of Mutinho and his role as the local patrão are similar to descriptions of the patrão recorded by Moran (1974). Moran describes a "good" as a person who looks out for the well-being of clients and settles disputes between neighbors.

new economic production mode, characterized by the integration of urban employment and income into an already complex livelihood system. Chapters Six and Seven examine new demographic patterns in Carvão and Mutuacá and the new structure of livelihoods today. While outlining current changes and providing a depiction of economic life in these changing communities, the discussion also seeks to determine the extent to which traditional rural activities, farming in the várzea and terra firme, fishing, hunting, and the collection and management of plant resources, are still conducted. The chapter also asks whether or not strategies typically associated with caboclos—flexibility, diversity, and dynamism are maintained in light of these broader changes.

CHAPTER SIX: A Community in Transition: Economic Strategies in Carvão, Brazil

Introduction

When I arrived in Carvão in the summer of 2003 to begin fieldwork for this dissertation, I was not quite sure what to make of the dusty upland community, where daily life was infused with both rural and urban images. In the early mornings, farmers walked down First Street in Carvão toward their fields with machetes in hand and woven baskets on their backs. In the evenings, men returned from the main village with fish dangling from a thin line—sometimes approaching houses to sell their catch. At the same time, however, shop keepers rose early each morning to sell groceries, beer, *cachaça* (sugarcane liquor), and bread; by seven in the morning, small crowds of villagers lined the First Street waiting for the public bus en route to Mazagão Novo and Macapá—where residents, mainly women, would shop, collect pensions and welfare payments. By ten in the morning, young men could be seen at various bars along in the village, playing dominoes, billiards, and listening to *brega,* pop music from northern Amazonia that tells stories of romantic mishaps, love triangles, and family feuds.

To complement this internal movement the community was itself growing horizontally across the landscape. Each month newcomers built small homes on the peripheries of the original village, which appeared to be expanding to the margins of the lakes and flooded savannas of the terra firme. The main village now consisted of an eclectic mix of houses built from plywood, brick, tin, and palm thatch. The mix of building materials gave the space a somewhat chaotic feel and indicated to me that growth in the community was occurring quickly and in a haphazard fashion.

Observations from fieldwork and an analysis of data collected through 12 months of interviews revealed that two closely linked processes, largely the result of the social and political changes occurring since the late 1980s described in Chapter Five, are occurring in Carvão and Mutuacá. The communities are growing both in population and physical extent, and in addition, older residents describe a process of livelihood change, whereby "nature"—the forest, streams and agricultural fields—has lost its central importance to household survival. Due to a mini-boom in the public sector and the growth of the informal sector in the region, Carvão and Mutuacá residents today have more opportunities to earn cash income. In response to these new opportunities, families in both communities integrate urban income, in the form of wages, pensions, and welfare payments, into a rural-based livelihood system. Increased cash flow has led to transformations in residents' subsistence patterns, where families purchase a much larger percentage of the food that comes into the household.

The next two chapters describe the processes of urban expansion and livelihood change in Carvão and Mutuacá, the spirit of which are conveyed in the descriptions above.[121] While this dissertation is most concerned with changes in residents' economic strategies and patterns of natural resource management, attention is given to both of these processes, as I have found that demographic changes also impact the local economy. For

[121] The process of urbanization in Carvão and Mutuacá can be described as the modification of two existing, historic communities that pertain to "traditional" Amazonia, as their settlement was a consequence of 17th century Portuguese colonial projects. Trends of urbanization in the study site thus differ from accounts of urbanization in Amazonia which has been a growing topic of interest since the 1990s. Previous research on urbanization in Amazonia (conducted by European and American scholars) has described the spatial impacts of large scale development projects in cattle ranching, mining, and the state-sponsored agrarian colonization projects that resulted in the proliferation of new boom towns surrounding capitalist projects such as mines, damns, and planned agricultural colonies scattered in the terra firme regions of Amazonia since the 1970s (c.f. Browder and Godfrey 1997).

instance, migration to the region fuels the informal sector and the diversification of local income earning opportunities has in part fueled the growth of the communities. This chapter presents the case of Carvão where urbanization (e.g. demographic shifts and changes in residents' economic strategies) is more pronounced. Chapter Seven describes these processes in Mutuacá and concludes by discussing how caboclos economic strategies in Carvão and Mutuacá compare to those described in the larger ethnographic literature on caboclos in Amazonia. It also examines whether or not in spite of residents maintain traditional elements of their livelihood systems and strategies characteristic to the Amazonian caboclo.

Following this introduction, the remainder of Chapter Six is broken into two broad sections. Section one provides background information on the community, describing the physical layout of Carvão, demographic patterns and local infrastructure (roads, electricity, and public services). I also examine the nature of local migration to Carvão, describing who is moving to the community, from where residents are arriving, and why new migrants are choosing to settle in the community. Together these descriptions convey a sense of the nature of urban expansion in Carvão, which is unplanned and haphazard. Section two describes economic patterns in Carvão—outlining the resources available to residents, the role of urban and rural activities to household economies, and the new patterns of natural resource management that have emerged within the last 15 years.

Results from household economic surveys reveal that families rely on both urban and rural activities to make a living. Urban resources in Carvão include wages and

payments from the public sector, as well as income earned from a budding informal economy. In addition, families in Carvão engage diverse rural activities, including the cultivation of manioc and perennial fruits, small animal husbandry, the management and extraction of açaí and bacaba, fishing and hunting. Perhaps because of its importance to the communities' history, manioc farming remains the most common rural activity, where 44 of 80 families (55%) maintain small annual fields. While a small number of families market forest and agricultural products, rural activities are largely conducted for subsistence purposes. Urban income on the other hand has largely replaced farm income. Based on the intensity of natural resource management (NRM), and the role of rural activities to their livelihoods, I identified four different family types in Carvão; however despite the variation in how residents combine specific resources, all residents rely on urban and rural resources—employing a hybrid livelihood approach. When compared to the recent past, Carvão residents have access to more income earning opportunities – and most have access to a stable source of monthly income whereas in the past earnings from the sale of forest and agricultural products varied from month to month. In addition, trends of urbanization have transformed the social structure in Carvão, where the community is no longer close-knit and made up of extended kin groups—and where the migration of poor migrants combined with increased circulation of cash income in Carvão has resulted in social differentiation on the basis of income and access to land. The above changes have occurred in conjunction with falling prices for traditional agricultural products and diminishing access to natural resources. Because of these challenges for most families maintaining a rural-based livelihood system is no longer

viable. Instead families must depend on both urban and rural resource as well as the social capital of extended kin networks to make a living.

Study Site

Physical layout of the community

Carvão today has greatly expanded since its second founding in the late 1960s. In 2005, approximately 700 people were living in the community spread out over 140 households (IBGE 2004).[122]These houses are themselves spread out over the three main sections that comprise the community: the vila, originally established in the late 1960s where the main public buildings and stores are located, the Queimada, the port entry to the Mutuacá River, and the newly settled area called the Ramal de Mirim (literally branch of Mirim), named after the igarapé accessed by a foot path from this area. The vila of Carvão consists of three parallel roads and several secondary footpaths all within close proximity of the original *casa da comunidade.* The original road is today referred either by its official name *Rua de José dos Reis Barreto*, after one of the communities' founding residents, or more simply as First Street. Today, the public buildings include a community center, where Alcoholics Anonymous group meetings are held, an elementary school, a community health center, a lower elementary school, a pre-school, a town hall

[122] Research from this dissertation corroborates IBGE population estimates. In 2005, I estimated a mean household size of 5 individuals per dwelling place (the number of people living at the residence when the interview was conducted [Table 6.1]). In a dynamic community, one that is growing with migration, and also where once located residents move continuously back and forth between the city and the countries, these likely do not account for all the people who rely at least part of the time of the natural resources. For instance, household size estimates excluded family members working and living in other community (who will likely return to Carvão at a later date). The figures did include on the other hand, school-age children living outside of the community to study during the school year but still dependent on the nuclear family.

(*Agencia Distrital*), a second community meeting center, which most often serves as a dance hall, two churches, one Protestant (belonging to the Assembly of God) and the other Catholic, six small stores, two of which also serve as bars, and one, hamburger shack. Radiating out from these three parallel roads are secondary roads and footpaths that descend into the flooded soils of the *campos alogados*, or lakes, *lagos*, as they are locally called (Figure 6.1).

The first settlement beyond the main village is located along the Ramal de Tomé, named after a long-standing community member, Sr. Tome Souza. The Ramal de Tomé extends through remnants of terra firme forests, and ends in a clearing, alongside an area of campo alogado, an used by the family to raise a small number of cattle, chickens and ducks. Four houses surround the main house owned by Sr. Souza and his wife, and was built in the 1980s (and rebuilt from 2000 to 2007). The second settlement is the Ramal de Mirim, which is more informally referred to as *a invasão* (the invasion) for its history of occupation described in Chapter Five. At the entrance to the Ramal de Mirim is a small decaying wooden house lined by aging mango and cashew trees. The deeply rutted road that runs through the Ramal de Mirim extends for about a kilometer before ending abruptly at a semi-abandoned property that belongs to a doctor from Macapá. At the edge of this property, the terra firme descends into várzea floodplains, leading to the igarapé de Mirim, which eventually winds into the Mutuacá River. The Ramal is home to about a dozen houses, half of which are permanently occupied.

Past the Ramal de Mirim on First Street (and approaching the Queimada) are two stray houses and a small road that leads to the *Escola Familia Agroextratvista de Carvão*

(EFAC) (translated as Carvão's Family School for Agro-Extractivism). The waterfront area known as the Queimada is the long term dwelling place of the Carmo family who settled in the area during the early 1900s. Today, a single wooden home is what remains of the small settlement of extended kin that once lined the upland banks of the Mutuacá River. Aside from his house, Sr. Nonato also built a large pavilion for use as a dance hall. Today the shelter also serves as a make-shift classroom or meeting place for the teachers at EFAC, and as a community meeting for residents in Mutuacá and Carvão. Approximately ten years ago, the *prefeitura* (municipal government) of Mazagão constructed several small tables covered in *bussú* thatch (*Manicaria saccifera*) and benches along the water front.

The Queimada is the main port in Carvão—the entry way to the adjacent várzea floodplains—and also serves as Carvão's swimming hole. Throughout the year, residents from the vila bicycle to the port to swim in the muddy waters of the Mutuacá River. The Queimada is particularly animated on Sundays during the summer months of July and August, the hottest months of the year, when Carvão residents and visitors spread out along the decaying tables, picnic, and swim under the aging rubber trees that line the water's edge.

Figure 6.1. Community map showing First Street, parallel streets, and public buildings in Carvão, Brazil.

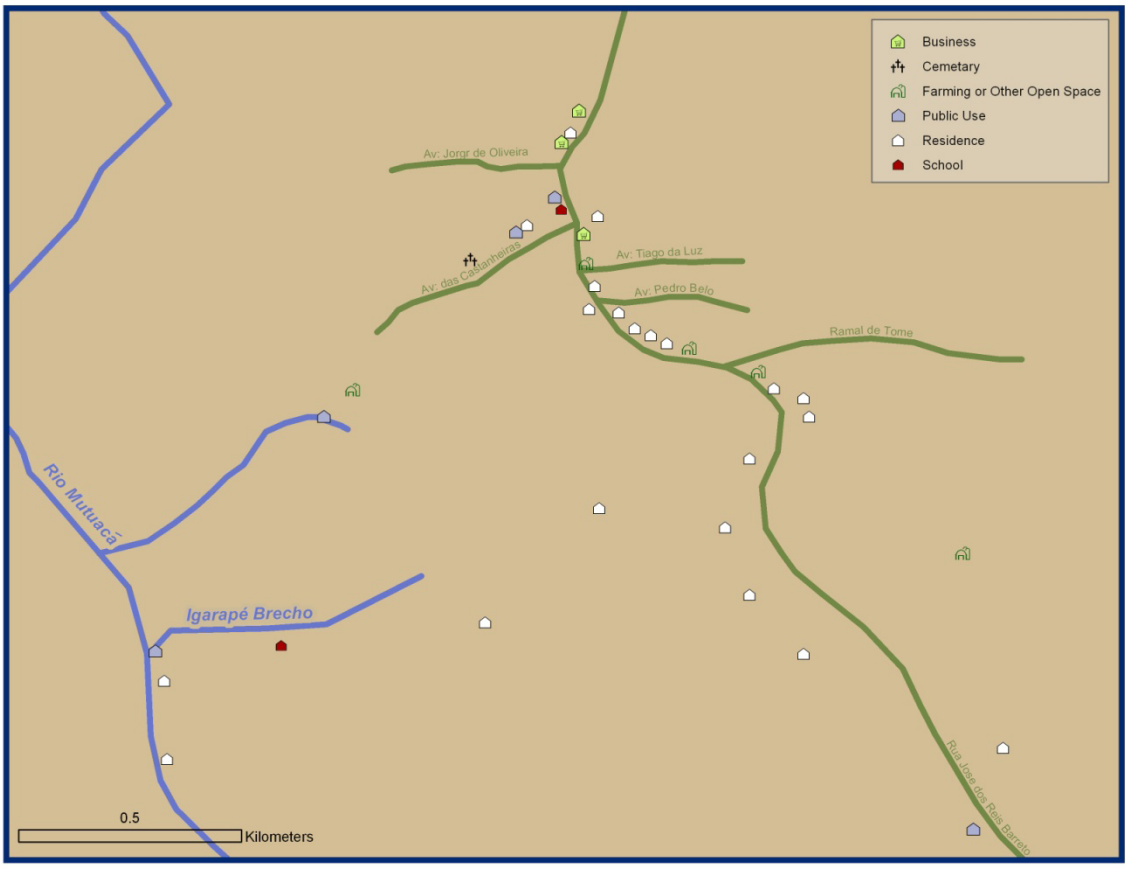
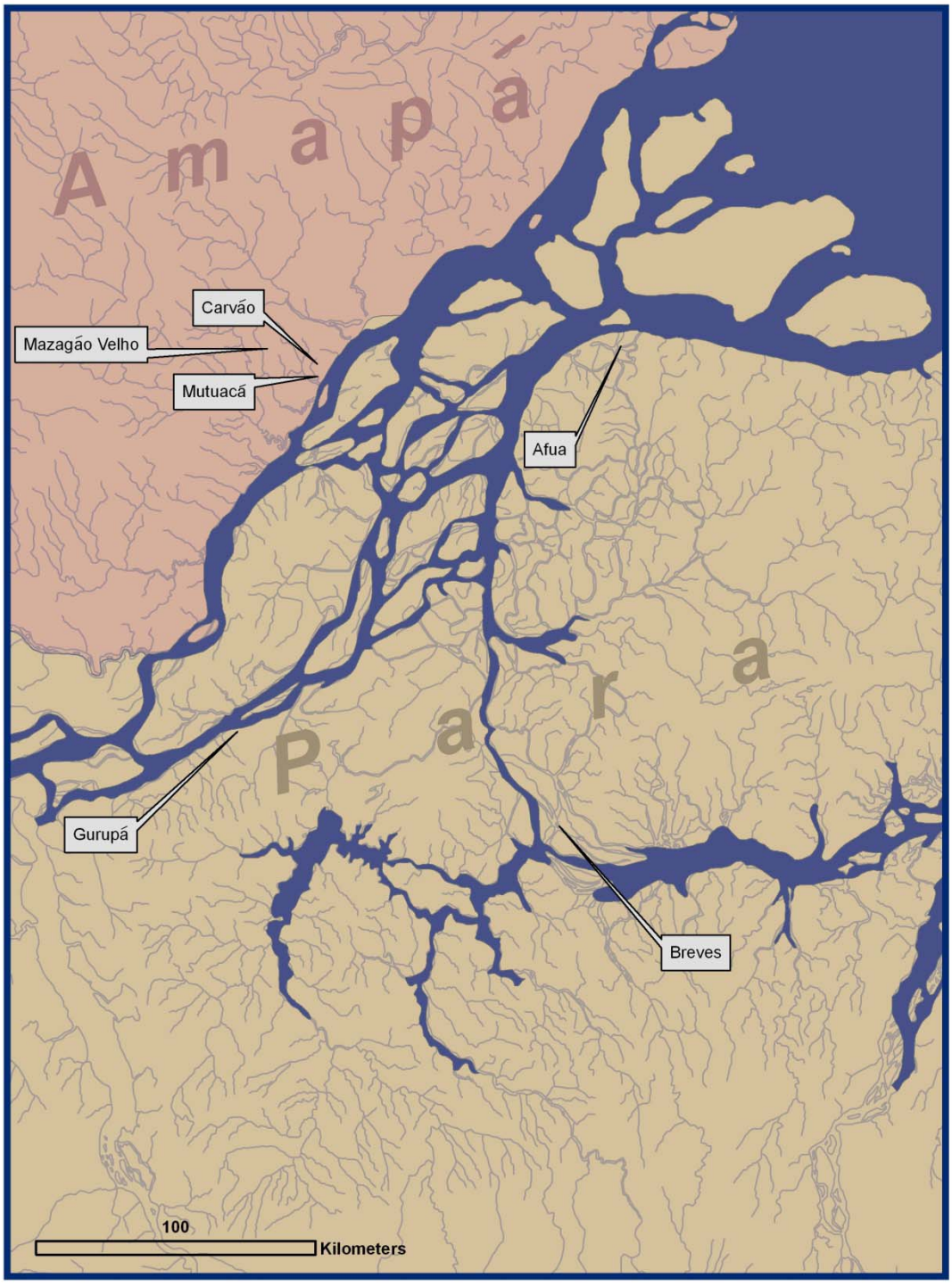


Figure 6.2. Map showing study communities, Carvão and Mutuacá, and cities from which Carvão and Mutuacá residents have migrated in the states of Amapá and Pará, Brazil.



Community Growth Patterns

Growth in Carvão is concentrated in the northern rural territories behind *Rua Camilo da Luz* (Second Street) and along *Rua José de Reis Barreto* (First Street); and is characterized by the addition of houses built mainly by poor residents with building materials quickly provisioned.[123] The expansion of Carvão is in part attributed to the "natural" evolution of the community—or the rise in the preexisting population primarily made up of the families who settled in Carvão during the second founding of the community. For instance, the Ramal de Tome is occupied by the adult children of the Souzas and their families; the Ramal de Antero, named after Sr. Antero Perreira, is now home to five houses belonging to Antero's children and relatives, and the Barreto family lives in a group of four adjacent houses that line the north side of First Street toward the entrance to Carvão.

On the other hand, data from household economic surveys indicate that many people living in Carvão today have recently arrived in the community. Data show that on average heads of households have lived in the community for 15 years, and that half of the interviewees have lived in Carvão for less than 10 years (Table 6.1). In addition, 71.3% of the informants reported to have lived less than half of their lives in Carvão.[124] On the contrary, only eight residents (10%) in the sample have lived in the community for more than 35 years and thus settled in Carvão during the early years of community building.

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[123] There are generally three types of houses in Carvão: wooden with thatched roofs, wooden with aluminum, and brick with clay Spanish styles. The latter are called *casas de venaria* and are considered the finest looking houses likely because they are more expensive to build.

[124] This value was determined by measuring residents' ages versus the number of years they reported to living in Carvão.

Table 6.1. Summary of demographic trends, Carvão, Brazil, 2005 (Results found in 80 household economic surveys).

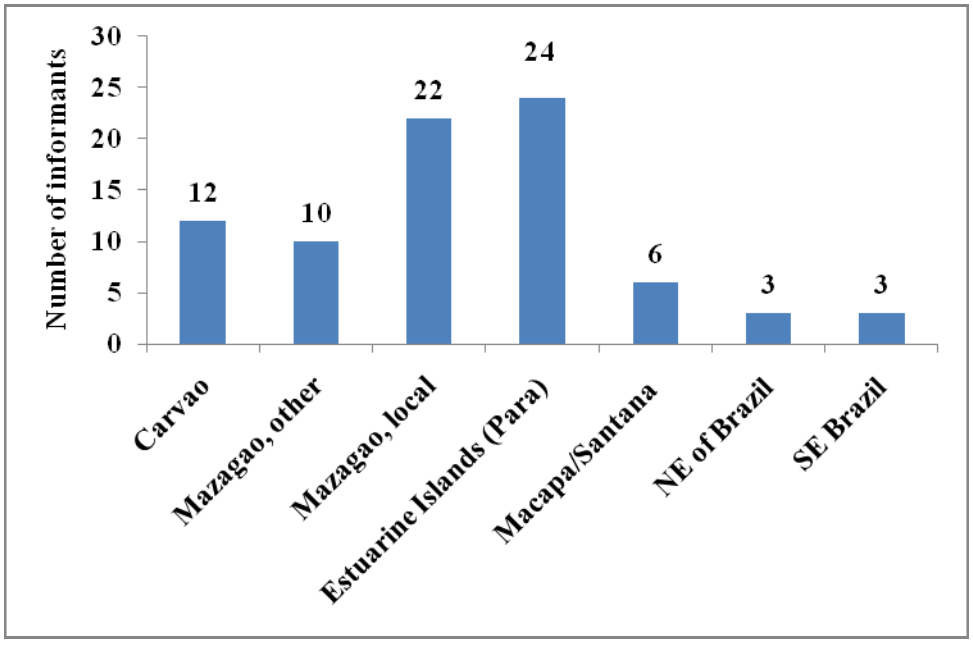
Variable	**Statistic**		
	Mean	**Median**	**Range**
Household size (no. individuals in/dwelling place) N=80	4.97	5	11
Area of landholdings (ha)/household N=38	29.66	15	110
Stable household monthly income (R$) n=51	621.37	450	2576
Residency in Carvão (no. of yrs.) N=80	14.56	9	70.8

Characteristics of local migration

The observation of local migration to the community prompts several questions, including: From where are migrants arriving? Is migration a local or extra-local phenomenon? Are people coming from cities or from rural areas? Data from household economic surveys provide some insight into these questions. Later in the discussion, I discuss the relevance of the process of migration to patterns of natural resource management in the community. Results indicate that almost all residents were born in the Brazilian Amazon; in fact, only six residents (7.5% of the sample) were born in non-Amazonian states (Figure 6.2). Forty-four residents (55%) were born in the municipality of Mazagão, twenty two of whom were born in the neighboring communities of the Foz de Mazagão Velho, Mazagão Novo and Mazagão Velho (which pertain to the category Mazagão-local on Figure 6.3). Another 24 residents (30%) were born on the nearby islands: Ilha do Pará, Afua, and Gurupá—landmasses located in the main channel of the Amazon River, all three of which pertain to the state of Pará (Figure 6.2), and lie within

approximately 300 kilometers of the study site. Thus, these data suggest that migration to Carvão is a local phenomenon.

Figure 6.3. Graph showing birthplaces of informants in Carvão, Brazil (results found in 80 interviews). Mazagão local refers to Carvão's immediate neighbors, including Mazagão Velho, Mazagão Novo, and the Foz de Mazagão Velho.



While birthplace data gives us an indication of who in Carvão is native to the region, because caboclos often live in many different places within the span of a few years, these data do not tell us from where new migrants are actually arriving. For this reason, recent migrants in Carvão were asked to describe the series of events that led them to the community. Out of the 21 residents who responded, five reported to live in the Foz de Mazagão Velho before moving to Carvão, three others lived in Mazagão Novo, and another five families had moved from more remote regions of Mazagão, including Maracá, Rio Preto, and Ajuruxi (Figure 6.3). In addition, two families had recently arrived from the interior Para, the municipality of Afua, an estuarine island; the remaining families had come from the cities of Santana, Macapá, and Fazendinha (a peripheral city of Macapá). These results thus demonstrate that migration to Carvão is indeed a local process, where the majority of new families are coming from within the municipality. In addition, research results suggest that migration to Carvão is largely a rural to rural phenomenon. Seventy six percent of informants indicated that they were raised in the "interior" and self-identify as caboclos (Table 6.2).

Table 6.2. Summary of demographic trends II, Carvão, Brazil, 2005 (Results of 80 household economic surveys).

Demographic trends (n=80)	**Yes**	**No**
Rural background	62 (76%)	18 (24%)
Born in Mazagão (county)	42 (52.5%)	38 (47.5%)
Access to land	40 (50%)	40 (50%)
Legal tenure	9 (11.25%)	71 (88.75%)
Stable monthly income	51 (63.75%)	29 (36.25%)
Cultivate annual/perennial crops in at least two production areas	44 (55%)	36 (45%)
Sell rural products (at least occasionally)	33 (41%)	47 (59%)
Engage in rural activities	66 (83%)	14 (17%)

Both the process of migration to Carvão and residents' motivations for moving to the community varies considerably between households. However, most recent migrants arrived in Carvão already knowing a community member and reported to move to the community to improve their access to social services. Informants with young children said they were attracted to Carvão because its schools are located directly in the village, and because between Carvão's three schools, all primary grades are covered.[125] In many rural areas in Mazagão on the contrary students travel great distances along deserted

[125] The Education system in Brazil consists of three levels, primary, secondary, and tertiary—equivalent to elementary, high school and college in the United States. Since 1971, students also study in pre-schools. Carvão has three schools, a pre-school that is funded by the municipality of Mazagão, and two elementary schools that cover grades one through eight and are administered and funded by the state government. To complete the three years of high school, students must attend schools elsewhere. Many students live with relatives in Macapá or Santana and a select number study at EFAC in Carvão; however, because EFAC serves various communities in both Amapá and Para it can not accommodate all high school students from its own community.

roads or canoe over rivers and streams (often with fast moving currents) to arrive at their schools. In addition, in most rural communities in Amapá, local schools only cover the first four grades. Likewise, some informants reported to move to Carvão to be closer to medical services where any moment they could travel over land to the county hospital in Mazagão Novo and from there be ferried to Macapá (which often occurs in serious cases).

New migrants living in Carvão also cited a number of personal reasons for moving to the community. The particular character of Carvão—a place that is not quite urban but not quite rural—was said to be in itself enticing. Silva, a young mother, originally from the interior community of Ajuruxi, first came to Carvão on a weekend church excursion. Silva explained that she found Carvão immediately appealing and after the trip decided to move to the community with her young family. She explained that in Carvão she is not as isolated as in Ajuruxi and at the same time the community is more peaceful than Santana (where she lived before settling in Carvão). Other residents said they came to Carvão because of land disputes between neighbors or family members in their native communities. Finally, some families came to Carvão because of work opportunities. In one memorable case a widow named Fernando arrived in Carvão after moving through Belem and Macapá. Freddy first moved from the interior of Afua with his family to the city of Belém (state of Pará). In Belém his wife fell ill and passed away; searching for a new life he came to Macapá and met a property owner from Carvão in need of a *casiero* (property caretaker). Freddy accepted the job and once in Carvão also began working in a brick factory in Mazagão Novo with a Carvão neighbor. In 2005, Fernando's 14 year-old daughter was watching over her younger siblings during the day.

Fernando explained that the advantage of living in Carvão was that he felt secure leaving his kids alone while working—not something he could do in the city.

Community Infrastructure

Roads and electricity

When discussing change in Carvão residents will often comment that the even though the vila is growing, local level infrastructure and public health conditions remain precarious on many levels. While many migrants cite schools as the primary reason for moving to Carvão, most complain both of the quality of instruction and the physical state of the schools. In 2005, all three schools were structurally deficient with leaking roofs and insect infested walls.[126] In addition, lack of state funding for health care has left the local health post without basic medical supplies and running water for several years. As is typical of many rural areas in Amazonia, all roads in Carvão are unpaved and deeply rutted with potholes. During the rainy season community roads are thick with red mud, making some areas, such as the *Ramal de Mirim* impassable during the winter months. Moreover, even though the vila was electrified over 20 years ago and most families have free energy through Amapá's state social program Luz Para Viver Melho (Lights to Live Better),[127] infrastructure is weak and the community suffers at least one power outage per week during the rainy season. In addition, wattage that reaches homes is limited due to the practice of energy sharing between homes, where in the new sections of town residents borrow electricity from their neighbors by running extension cords between

[126] From 2006 to 2007, community leaders obtained state funds to reform the Fagundes Varela School. Today, a modern brick school sits in the original location.

[127] The Ramal de Mirim and the Queimada received electricity six years ago, as did the várzea communities in the Foz de Mazagão Velho. These later installations were part of an ongoing state-wide campaign to bring energy to rural communities in Amapá.

adjacent houses; because of limited power, families and business owners can only run one appliance at a time.

Water and public health

According to a recent study conducted by the Institute for Ecological Research in Amapá (*Instituto de Ecológia de Amapá*-IEPA), 50% of homes in the community have piped water from the public waterworks system of Amapá (CAESA). My own observations, however, suggest that this figure is lower. In the peripheral areas of the community, for instance, many homes often share a water supply, fetching water daily with buckets stored in their kitchens and home gardens. In addition, houses in the more rural areas of town, such as the Ramal de Mirim and the Queimada not always visited by outsiders are not connected to the public water system, but obtain water from individual wells either pulling up water manually with a rope and pulley system or using an electric pump that pushing up through plastic pipes.

Rapid growth in recent years has made access to potable water and public sanitation an ongoing challenge in Carvão. During the long dry season, CAESA water reserves are insufficient to meet the community's water needs. During the summer, water flows during the early morning and dries up around ten AM, and returns again in the evening around five or six PM. In the dry season residents plan their days around the water schedule, filling buckets for cooking and washing to prepare the mid-day meal and carry them through the evening. Families prepare dinner and wash accumulated dishes when water returns in the evening. During the summer months, modern toilets (built within the last decade ago as part of a state-funded rural development program) rarely

function, which is not only a nuisance, but causes unsanitary conditions exacerbated by the concentration of houses in the newly settled areas of town. Finally, the most crucial consequence of rapid growth and the concurrent accumulation of stagnant water (runoff from cooking and washing and buckets stored in home gardens) in peripheral areas of the community, is the rapid increase in mosquito born diseases in Carvão. In 2005, over 100 cases of malaria were reported from Carvão, a level considered epidemic by public health officials in Mazagão Novo.

In summary, Carvão is expanding rapidly due to migration by caboclos from nearby communities; new migrants cite various motivations for settling in the community, but largely move to the vila in hopes of improving their social condition. Community level infrastructure remains haphazard and has implications for public health and residents' ability to maintain a high quality of life. Having described the process of community expansion in Carvão and its significance for residents' quality of life, the discussion examines local economic strategies and patterns of natural resource management in this changing community. This discussion builds on Chapter Five and represents another period in a long history of economic change.

Making a Living in Carvão

Landholding patterns

When families began to move back to Carvão to cultivate manioc in the 1970s, land in the vicinity of the community land was plentiful, and families for the most part had ample choice of property. At the time, the local economy centered on rural activities, and thus access to land was crucial to survival and a family's most valuable asset. Due to shifts away from a rural-based livelihood system access to land is no longer essential to

residents' survival; this change is reflected in current patterns of land distribution and tenure in Carvão today. Data from fieldwork indicate that 40 residents (50% of those interviewed) have access to land for use in agriculture or the elaboration of rural activities (Table 6.2). Of these 40 residents, twenty eight land owners have access to land in the terra firme of Carvão; nine respondents (22.5%) have land in the adjacent várzea areas in the Foz de Mazagão Velho, and five households (12.5%) reported having access to both várzea and terra firme lands. The average size of landholdings was calculated at 29.66 ha (Table 6.2); however, this figure is skewed by larger várzea properties (on average 50 ha); the median figure for area of landholdings, 15 ha indicates that majority of families with land have access to relatively small areas (Table 6.1). The data on area of landholdings patterns also illustrates that land is unevenly distributed throughout the community with the range in landholdings from three to 112 ha.

Land tenure patterns

During the 1970s when INCRA first began distributing land throughout rural Amapá a limited number of farmers applied and obtained legal titles to their land. As discussed in the previous chapter, from this point forward, there emerged four distinct land tenure arrangements in Carvão: (1) legally recognized tenure, where the farmers holds a title to the measured property and pays taxes on his land; (2) a more informal documentation, where farmers hold a document of possession (posse), which gives them the right to use the land even though the land actually belongs to the government; (3) informal tenure, where land is not legally owned, but recognized by the public as belonging to one farmer (through continual use); and (4) a situation of land borrowing, where a neighbor or family

member works on another's land. In the latter case, the farmer owns only his crops but not the land underneath them.

In 2005, only nine Carvão residents (22.5%) out of 40 with access to land had legal titles to their land (Table 6.2). The remaining families either had a document of posse or had no documents at all. In the latter case, families had generally occupied a piece of land for so long that the property was recognized by others in the community as pertaining to the larger kin group. Finally, in addition, seven families in Carvão identified themselves as landless manioc farmers. In these cases, farmers worked on land borrowed from a neighbor or relative; land-borrowing farmers tended to use a verbal contract system called a *contrato de passaria*. Observations from fieldwork illustrated landless, land-borrowing farmers compensated landowners for the use of their land in various ways. In some cases, land-borrowers used land without any obligation of repaying the landowner for the use of his land. In other cases, land owners are paid with half the crops produced from his land, and in the final case, the owner receives half of the profits from the sale of goods from the land.

The Rural Economy of Carvão

Despite the changes occurring in the study area, data from household economic surveys indicate that residents engage in a diverse number of agricultural and extractive activities (Table 6.3). An analysis of results shows that small scale production of manioc remains the most important rural activity, with 39 families planting annual fields covering at 0.2 ha. For a select number of families (14 out of 80) the sale of rural products is still a main source of cash income; however, most families gear rural production toward household consumption or occasionally sell products to cover unexpected expenses. Table 6.4

summarizes major patterns of natural resource management and identifies family types based on how resources are managed and the role of rural activities to families' economic strategies. Figure 6.4 compares the means of four socioeconomic variables (residency, household size, stable income (from government sources) and size of landholdings between these groups). Based on statistical testing (Analysis of Variance -ANOVA), the landholding size (ha) and residency values were found to be significant with P-values of 0.00171 and 0.07 respectively. In the case of landholdings, residents in NRM group 1 and 2 were more land wealthy. Only two residents in group three had land and nobody in group four had access to land. For residency values, the more rural groups had also lived in the community for the longest period of time.

The remaining discussion describes the role of particular rural activities to families' economic strategies in Carvão and the local technologies employed by residents. In particular, I provide a major characterization of agricultural production in Carvão today, outlining the role of farming to households, major crops planted (and vegetation types maintained, as well as marketing strategies. This discussion thus complements Chapter Three which described farmers' management strategies and patterns of agrobiodiversity in the study area.

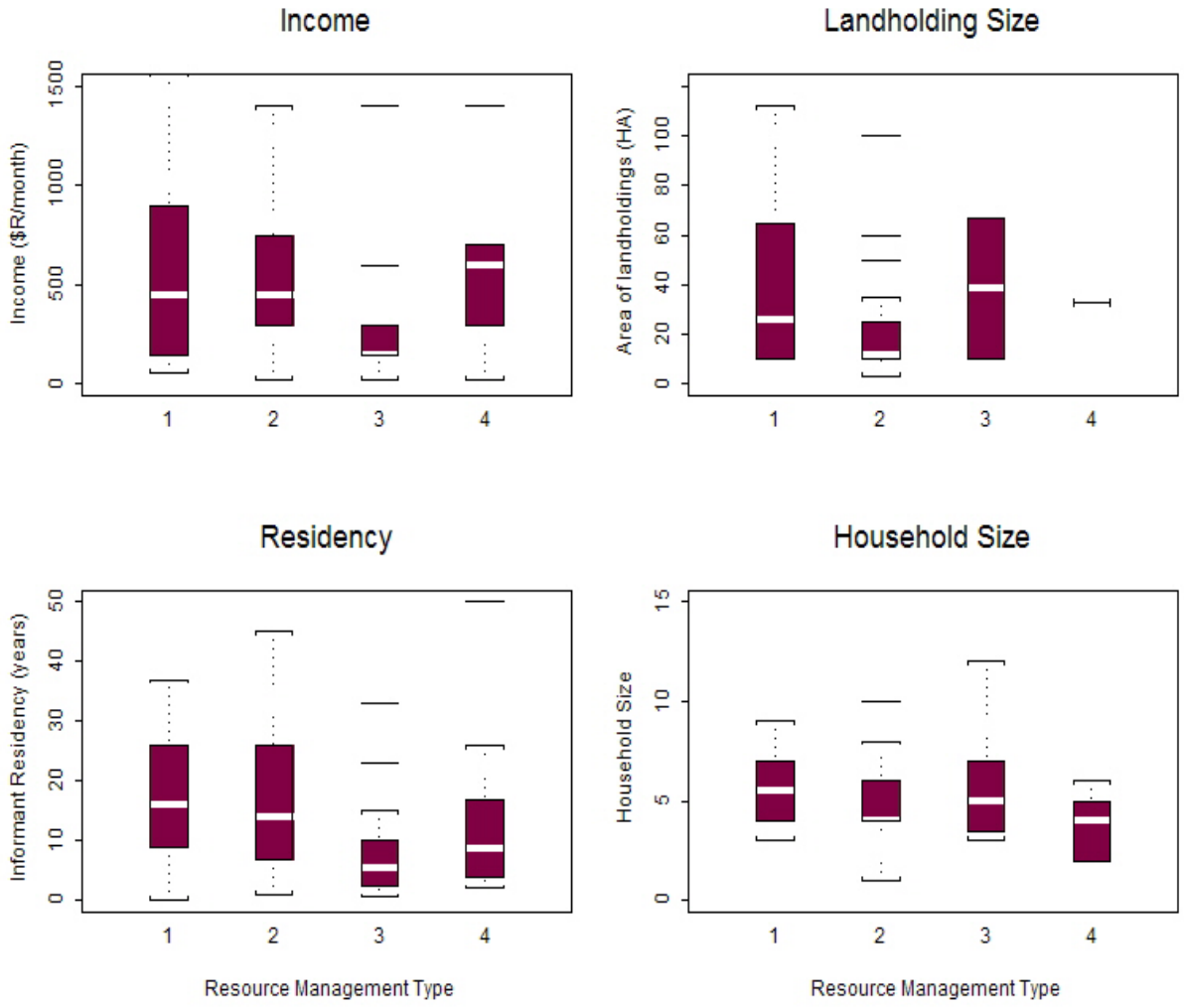
Table 6.3. Rural production activities, Carvão, Brazil, 2005.

Activity	Total number of households participating	Number of households engaging in commercial production
Cultivation of manioc or other annual crops	**44**	**23**
Perennial fruit cultivation/home gardens	**---**	**3**
Small animal husbandry (ducks, chicken)	**15**	**0**
Cattle production	**1**	**0**
Collection of açaí/bacaba	**18**	**5**
Fishing	**25**	**1**
Hunting	**15**	**0**

Table 6.4. Carvão-Family "Types" based on natural resource management (NRM) patterns.

NRM Type 1: Families in this group (n =14) sell rural products on a regular basis and combine commercial production with at least one subsistence activity listed on Table 6.3.	**NRM Type 2:** Families in this group (n =32) maintain at least 0.2 ha of land in annual cropping and engage in diverse subsistence activities. Families cultivate primarily for subsistence purposes, but may also sell crops on occasion.	**NRM Type 3:** Families in this group (n =20) engage in rural activities limited to: home garden production, small animal husbandry, and forest extraction. All activities are conducted for subsistence purposes.	**NRM Type 4:** Families in this group (n =14) do not engage in rural activities, but rather earn income from urban sources and purchase their food.
Example: The Dias Family	**Example: The Gomez Family**	**Example : The Alfaia Family**	**Example: The Bahia Family**
Socioeconomic Variables: -Household size: -Years living in Carvão: 37 -2005 Stable Income: R$300 -Area of landholdings: 32 HA	**Socioeconomic Variables:** -Household size: 6 -Years living in Carvão: 4 -2005 Stable Income: R$150 -Area of landholdings: 5 HA	**Socioeconomic Variables:** -Household size: 3 -Years living in Carvão: 24 -2005 Stable Income: R$0 -Area of landholdings: 0	**Socioeconomic Variables:** -Household size: 4 -Years living in Carvão: 8 -2005 Stable Income: R$700 -Area of landholdings: 0
Sources of cash income: -Retirement pension and remittances from children living in Macapá. -Sale of farinha in Mazagão Novo to local grocer and relatives; occasional sale of farinha and fruits to neighbors on request.	**Sources of cash income:** -Welfare payment (bolsa família)	**Sources of cash income:** -Daily wages from construction work	**Sources of cash income:** -EFAC salary for school transportation -Earnings from grocery store in Carvão

Figure 6.4. Box-plots comparing the median value of socio-economic indicators between natural resource management groups 1-4



Agricultural Production in Carvão

Agriculture in Carvão today centers on the production of manioc and the management of diverse annual and perennial plants in mixed home gardens. Out of the 66 families who engage in rural activities, 44 were found to maintain an area of at least 0.2 ha of annual cropping, and most families maintained home gardens with various patterns of crop diversity. Annual cropping is dominated by manioc, with 39 out of 44 farmers planting manioc in the uplands in addition to their home gardens. Nine of these manioc producing families also cultivates either corn or beans in addition to manioc in either the terra firme or várzea. In addition, four non-manioc producing families planted annual fields in the várzea areas of the Foz de Mazagão Velho. As is typical of várzea production systems, these four fields were generally planted with three or more crops, such as sugarcane, corn, beans, and squash. Finally, six families living in Carvão but primarily working in Mutuacá were maintaining agroforestry systems dominated by açaí stands.

Out of these 44 families, 14 sell agricultural products on a regular basis. Eight families market agricultural products, primarily farinha and other manioc-derived products at the state agricultural market in Macapá or in Mazagão Novo, and depend on the sale of farm goods as a primary source of cash income. Five families in this group sell açaí fruits or pulp to *batedeiras* or individual consumers Carvão, where local demand for açaí pulp generally exceeds the local supply. Another farmer, Sr. Beni, sells herbs and vegetables from his home garden almost daily in the vila of Carvão. The local demand for fresh herbs and vegetables is so great that a farmer Sr. Beni, who lives just outside the village often, sells all of his goods before reaching the main section of town.

In addition to farmers who sell products regularly, 18 families in Carvão reported the occasional sale of farm products (Table 6.2). These famers use irregular farm income to cover unanticipated expenses, for instance, to pay down medical bills or local store accounts; others use the income to invest in their properties. One informant explained that he produces a few sacks of farinha for sale when local store owners will no longer allow him to buy on credit. Another farmer told me that while she mainly grows manioc and fruits (in her home garden) (for household consumption, she often uses the money she earns annually by selling cupuaçu pulp (*Theobroma grandiflorum*) in Carvão to buy an object for her houses. In 2005, she used the earnings from fruit pulp sales to replace her gas stove.

Farmers in this second group ("the occasional sellers") tend to market their products locally, catering to the growing demand for agricultural products in the vila, which has grown in recent years as a result of shifts away from farming. In the past when all families were more dedicated to diverse forms of production, agricultural goods—especially manioc products were in excess in Carvão, and farmers could not imagine selling products to their neighbors. In recent years, however, it is often difficult for non-agricultural families to obtain locally produced goods. Residents who work in salaried positions often commented on the irony of living in a rural area, where it is difficult to find fresh food. Most complain of the scarcity of fresh fruit and vegetable, but some even remarked that it is difficult to purchase farinha. In March of 2007, one manioc farmer, Sr. Marcio, described the recent period of farinha crises. In December of 2006 when farmers planted their manioc fields, the winter rains (necessary to ensure the growth of the new crop) arrived almost two months late, which caused many farmers to lose their fields. In

addition, residents who up until 2006 were dedicated subsistence producers, decided to forgo planting, imagining they would simply buy their farinha. By March of 2007 when I returned to Carvão people spoke of the great scarcity of farinha in the vila. Sr. Marcio joked that given the scarcity, working to produce manioc flour in the public retiro was becoming a dangerous occupation. He explained that residents seeing the smoke from the fire in the retiro many residents approached his family wanting to purchase fresh farinha, and often left angry after being told that the flour was not for sale, but rather reserved for the family's own consumption.

In addition to Sr. Marcio, 14 other families reported to produce manioc for subsistence purposes. Because food is the greatest household expense in Carvão and most families report to buy almost all goods that come into the household, the production this staple food consumed in great quantities over the course of a month, allowed families to economize cash coming into the household. The importance of subsistence planting to families' economic wellbeing became most apparent to me in 2007 during the farinha scarcity. Visiting in the evening with friends outside the elementary school in Carvão, I spoke with Sr. Lorenço, a long-time farmer who now works evening as a security guard for the school (and also works every other day on his properties in Mutuacá and the Ramal de Mirim). He expressed with sadness that the past year had been particularly tough for his family. He said that without their manioc, the family had to purchase everything they consumed, and without the savings that producing their own farinha usually provided them, the family could not survive on his salary alone. Over the course of March 2007, I spoke with other individuals who told similar stories of regret—all

expressing that urban cash income alone could not carry their families through the month given the high cost of food in Amapá.

Finally, many farmers in the last two groups reported non-economic motivations for engaging in agricultural production. Some farmers reported that they liked to produce their own goods to ensure their quality. For others, farming is a leisure activity. Many elderly residents believe that by continuing to farm, they will maintain their health and live longer. Other pension-receiving farmers continue to cultivate in the urbanizing community as a way to assert their identity as rural producers—an occupation that has gained value in Amapá and Amazonia as a result of regional social movements. Lastly, recent migrants to Carvão often plant manioc or perennial fruit trees near their homes to stake claim to a newly acquired piece of property.

In sum, residents in Carvão cultivate a variety crops in a complex and diversified agricultural landscape. While farmers plant for a variety of reasons, agriculture today has taken on a quasi-subsistence role, where families mainly produce for their consumption, but occasionally sell products locally to cover unexpected expenses. Despite the obvious shift away from farming families speak with authority on the importance of subsistence production to their livelihoods, as producing allows families in Carvão to stretch monthly cash earnings.

Other Rural activities

As indicated on Tables 6.3 and 6.4, families in Carvão participate in a number of other rural activities. These activities are often conducted in conjunction with agricultural production in the terra firme and várzea areas. With one exception (a man who sells fish

daily in Carvão) data reveal that rural activities other than cultivation are undertaken for subsistence purposes. Nineteen families reported engaging in small husbandry activities—including raising chickens (15 families), ducks (3 families) and cattle (1 family). In addition, in 2005 two families were preparing várzea areas in Mutuacá to raise cattle. In addition, fifteen families reported occasionally collecting açaí in the várzea areas of the Mutuacá River, and because they do not have their own access to várzea lands admitted to collecting açaí fruits on other people's lands.[128]Another three families reported collecting bacaba fruits (*Oenocarpus bacaba*) on their own lands in the terra firme for home consumption. Twenty five other residents reported to fish using hooks and lines or nets on occasion (mainly during the summer months) in the waterways in the Foz de Mazagão. Fifteen residents reported to hunt with rifles on occasion in the terra firme mainly in an around agricultural fields, where small rodents like paca and cutia are commonly found.

The Urban Economy of Carvão

Results from the 2005 household economic surveys revealed that the majority of Carvão residents earn their cash income from through the urban economy from both formal and informal sources. The formal economy in Carvão is largely made up jobs and payments coming from the state, local and federal governments (Tables 6.5 and 6.6). The informal economy consists of jobs from a growing service sector, in which residents work for daily wages, and a number of family-owned businesses, including grocery stores, bars, and snack shops (Table 6.7). Income from government sources in the form of wages and

[128] Landowners in Mutuacá often complain that Carvão residents invade their land and collect açaí fruits. Because açaí is a native plant that grows spontaneously in the forest, many believe it is a common resource for all families to use. Landowners, many of whom actively plant and manage açaí on their land disagree and consider "open" collection to be an act of theft.

payments is earned on a monthly basis, and provides families with a stable, dependable income. Income earned from informal wage work, and from family-owned businesses, on the other hand, is not stable, and can vary considerably from month to month. Out of 80 households, 51 families in Carvão (64%) received some type of government income either in the form of wages, pensions or welfare benefits, and 28 families in the survey do not receive any government income, and therefore do not have a stable monthly income (Table 6.2). Range in income was equal to R$2576[129] (with families earning in between $R25 to R$2600 (Table 6.1). The mean stable income was calculated at R$621.37 earned from government sources alone (Table 6.1), and the median income was considerably lower at R$450 per month. When compared to estimates of total household income at the municipal and state levels, income values for Carvão are higher, compared to total average income of households in Mazagão and $R328.55 in Mazagão and R$593.91 in Amapá (IBGE 2000).

The public sector

Nineteen residents in a sample of 80 (23.75%) were found to be employed by the state government of Amapá, and worked in various occupations, as teachers, agricultural extension agents, security guards, school cooks, general school servants, nurses (Table 6.5). Salaries earned for work in these occupations range from R$300 to R$1600 a month (Table 6.5). Professionals, teachers and agricultural extension agents, earn from 1200R$/month to $1600 a month. Residents working as nurses and school support staff earn lower salaries from R$300/month to R$600/month (Table 6.5). Nurses who are also

[129] The Brazilian Real in 2005 vacillated between R$2.4 to 2.1 to 1US$. The current, October 2007, value is R$1.8 to 1US$.

professionals and have obtained a technical education (beyond high school) earn a modest salary ranging from $R450 to $R600 a month.

In addition to state employees, a limited number of residents are paid by the federal and municipal government, working as schools servants and/or nurses in Carvão (Table 6.5). Two additional residents earn a monthly income of R$2000 a month despite the fact that they no longer work in their positions.[130] Federal government employees receive higher monthly salaries (R$100O to R$2000), and have received stable income for the longest amount of time in the community. The single employee of the *prefeitura* of Mazagão earns $R450 per month as a nurse in Carvão.

In addition to wages, many households in Carvão receive payments (pensions or welfare benefits) from the state, federal and municipal-level governments (Table 6.6). Data from household economic surveys indicated that 68 different payments are distributed over 80 households (Table 6.6). In 2005, residents in the sample received income from ten different government programs, earning anywhere from $R25 to $R300 a month per payment. Rural retirement pensions financed by the INSS were the most common payment earned in Carvão with 18 pensions distributed over 80 households. Households also received five disability pensions and five additional pensions for the death of family members (Table 6.6). Other pensions included disability pensions and pensions for deceased family members. In addition, residents received income from five

[130] When Amapá became a state of the federation following decentralization in 1988, many prior federal employees (of the federal territory of Amapá) were kept on the federal payroll despite the fact that the agencies for whom they work dissolved. Across Amapá, many people are in this "lucky" position. In the case of the two residents who receive these phantom salaries in Carvão, both moved back to the community after their agencies folded and earn high salaries by community standards. Both are originally from Carvão and contribute a great deal to the community. One operates a small store; the other has been involved in local politics, and both continue to farm for subsistence purposes.

welfare programs, including two federal, one state, and one municipal program, the *Bolsa Escola*, *Bolsa Família*, and *Bolsa Cidadão*, and *Bolsa Peti* programs respectively. All of these programs, with the exception of Bolsa Escola and Bolsa Peti, award families $R30 a month per child and are meant to cover expenses of school children. The other welfare payments are given to defray household food and clothing costs, and in 2005 awarded families $R150 per month. In addition, two residents reported earning a monthly salary from Amapá's *Bolsa Parteira* program that provides a stipend of $R150 to women who have traditionally worked as midwives in rural communities. The stipend is not meant as a payment for midwives' services but is to recognize women's role in providing health care in rural communities where services are limited.

Table 6.5. Source and number of government wages in 80 households, Carvão, Brazil, 2005.

Source	Total per Category	Source	Total per Category	Source	Total per Category
State government	18	Federal Government	5	Municipal government	1
Positions		**Positions**		**Positions**	
Teachers	2	School servants	1	Nurses	1
Agricultural extension/development	2	Nurses	2		
Escola Família de Carvão employees	1	Federal employees, general	2		
School employees (general)	4				
School transportation	2				
Nurses	3				
State employees, general	3				

Table 6.6. Number of government payments (pension and welfare benefits) in 80 households, Carvão, Brazil, 2005.

Source	**Total /category**	**Source**	**Total/ category**	**Source**	**Total/ category**
Federal Government	39	State government	5	Municipal government	7
Program		**Program**		**Program**	
Bolsa escola	4	Bolsa cidadão	3	Bolsa peti	6
Bolsa família	6	Bolsa parteira	2	Widower's pension	1
Disability pensions	5				
Retirement pensions	18				
Maternity payments	1				
Widower's pension	5				

The informal economy

The infiltration of income from government sources has propelled a parallel informal economy in Carvão. Out of 80 informants, 33 residents responded to working at least part time in the informal services sector (Table 6.7). Carvão residents work in the local service sector as farm hands, maids, babysitters, in construction, in transportation, and even providing entertainment for area parties (DJs). A number of other informants own bars and stores or sell prepared food from their residences on Sundays and holidays. Some residents earn a bulk of money selling traditional foods at the Festa de São Tiago in Mazagão Velho during the month of July. In addition, two households reported earning remittances from adult children who work in Macapá as maids. Finally, two other residents earn cash income by renting out houses in Carvão. In one case, an informant told me that when families leave Carvão, the owners often want to sell their old homes quickly, and taking advantage of the situation, he offers to buy them on the spot inexpensively. He later rents to homes to new occupants, such as school teachers who live part-time in the community for R$70-100/month.

Residents who participate in the informal economy also found it difficult to calculate monthly earnings. Residents working for daily wages (*diárias*) for services (i.e. construction and farm workers) were paid from R$10 to R$15 a day. While wages remained consistent throughout the year, informal service work becomes available periodically and thus means that the number of days residents work in a month varies considerably. Agricultural day laborers for example have more consistent work during the planting and harvesting seasons and may find sporadic work weeding fields in between these periods. Local work in construction and in area sawmills in the várzea is

also periodic—depending on local demand for services and products. The two male heads of household who work in the local brick factory in Mazagão Novo were an exception to this pattern; these men work from 15 to 20 days a month and earn from R$225 to R$300 a month. Finally, the two domestic workers interviewed in this study earned around R$200 on an informal contract basis (Table 6.7).

For the most part, local business owners do not track earnings and expenses regularly and thus had difficulty reporting a monthly income. One shopkeeper who I interviewed in 2005 was an exception to this pattern and reported to earn approximately R$700 a month in grocery sales. Local business owners explained calculating earnings (even if they had the desire to do so) is complicated by the informal credit system that operated in Carvão, called buying *fiado* or *comprar fiado* (which translates as buying on trust). When a customer buys on credit his purchases are recorded on his account (kept in a spiral notebook). Some customers regularly pay down their debts from month to month when the family earns cash wages; others, however, neglect to their accounts for long periods of time and do not pay debits whatsoever. In the latter case, store owners wind up absorbing customer debts. Aware of the danger of the fiado system (responsible for the high turnover rate of stores and bars in Carvão) store owners have developed various strategies to deal with the custom. During my stay in Carvão signs would periodically appear in the front of stores saying "*não vende fiado*" (we do not sell on credit). In other cases, owners resolved to extend credit only to families who receive monthly government payments. Still others attempted to extend credit only to those select individuals who pay down their accounts regularly. These rules however were always flexible and often reversed, as most store owners found it difficult to turn away needy customers, especially

when customers were family members. The fiado system is important to this discussion as local credit is an important resource for families, and has over the past ten years increase local food security in Carvão.

Table 6.7. Number of residents who participate in the informal economy, Carvão, Brazil, 2005 (n= 80 households).

Informal services	Total per category	Local businesses	Total per category	Misc. income	Total per category
	27		14		5
Laborers, agricultural	13	Stores/bars	5	Remittances	2
Laborers, construction	8	Transportation	6	Rent	2
Laborers, sawmills	2	Food vendors, parties	2	Child support	2
Laborers, domestic	3	Disc Jockey, Parties	1		
Laborers, Brick factory	2				

Summary: Toward a Characterization of Economic Strategies in Carvão

The results outlined in the two previous sections indicate Carvão residents have access to diverse resources—including salaries and payments from the public sector, income from the informal service economy, and natural resources. Data indicate that residents primarily earn cash from urban sources—of which salaries and payments provide a stable monthly income and earnings from the informal sector vary from month to month. Residents engage in diverse rural activities, including small scale agriculture and forest extraction, which are primarily undertaken for subsistence purposes but also, provide residents with an occasional source of cash income. Results from surveys also indicate that these resources are unevenly distributed in Carvão. Economic data show that 63.75% of the sample population receives a stable source of income each month; however, within this sub-group, the observed range in income level is great (from R$25 to R$2575). Likewise, there is differential access to land in Carvão—where 50% of informants replied having use of an area considered their own; again within this sub-group, the range of landholding size was considerable (from 3 to 10 ha).

Moreover, within the sample of 80 households, no family was found to combine the same activities and resources in the same way. Despite the diversity in economic strategies, data indicate that with few exceptions Carvão residents rely on both urban income and work with rural work of goods to survive. Thus, in characterizing livelihoods in Carvão today we can conclude that residents' livelihoods are hybrid in nature, as individuals integrate new resources with rural activities and age-old strategies of exchanging goods and labor with neighbors and extended kin. Residents often conveyed this complexity by describing household survival strategies, where most informants

explained that to survive they dabbled in "a little bit of everything." One informant in particular, Sr. Pedro, provided a clear description of how his family uses urban and rural resources over the course of the month. Sr. Pedro explained that at the beginning of each month his wife receives a welfare payment (from the *bolsa familia* program), and first purchases school supplies for their four children and then uses the remaining funds to buy food. The store-bought food however is consumed quickly and thus to carry them to the next payment, Sr. Pedro first buys goods on credit in Carvão and then heads to his brother-in-law's property in Mutuacá to fish and hunt. In describing his family's consumption strategy, Sr. Pedro said that in his opinion, life in Carvão was not easy nor was it difficult, but with the help of the bolsa, with help from his extended family, and by relying upon nature, they find a way to survive from month to month (*da um jeito*…).

The need for economic diversity in an urbanizing community

In comparing residents' current economic strategies with those of the recent past (from the 1970s to the mid-1980s) we can thus conclude that over the past fifteen years families have replaced farm income with urban income, and today purchase most of the food that sustains their families. Shifts toward a more urban livelihood system are possible because of the increase in income earning opportunities in Carvão occurring since decentralization and the subsequent mini-boom in the public sector in Amapá after 1988. Community-wide shifts away from farming are curious however given that much of the income earned in Carvão today comes from welfare payments and pensions—sources which do not require additional labor input. This observation thus leads us to question why farmers give up commercial farming, and also the opportunity to accumulate wealth. Farmers cited multiple reasons for downsizing their production in recent years. Many

explained that upland farming, which centers on manioc (one of the few crops that can grow in the acid, dry soils of the region), does not provide adequate financial returns. Farmers reported that after 1994 when Amapá began importing farinha from Pará, Brazil (produced in large quantities under mechanized conditions) prices had fallen across the Amapá—such that labor inputs needed to produce farinha could no longer be justified. In addition, many residents, especially recent migrants, said that limited access to land kept them from elaborating agricultural production on a larger scale. Retired-aged farmers often said that they would farm given access to labor. In many of these cases, their children were tied up studying with the aim of obtaining a secure government job, and thus did not have time to help families' production efforts. In a similar vein, many residents lamented their dependence on store-bought foods, saying that over the past ten years fish and game stocks have become so depleted that wild sources could no longer meet the community's food needs. From this perspective, it is clear that the urban economy in Carvão emerged in concert with the new challenges, which make it difficult for families to live through rural activities alone. Families must rather secure income urban sources and rely on other safety nets such as informal credit and extended kin networks.

Discussion and Conclusions

Over the past 15 the social structure in Carvão has changed as have residents' internal patterns of natural resource management. Whereas 15 years ago, Carvão was a close-knit rural community made-up primarily of extended kin, migration has prompted the integration of new families into the community who are not related to the original families of Carvão (who were largely of African descent) and often with different ethnic

identities and life experiences. In addition, migration to the community and the mini-boom in public income has resulted in a community stratified on the basis of access to resources (cash income and land). In Carvão today government professionals have the highest incomes and most often have "better homes" (made of cement brick as opposed to wood and with urban appliances), and poor residents (mainly work as maids, babysitters and general laborers wages. Likewise, new migrants are also land poor as compared to longer-term residents. Disadvantaged both in terms of access to land and income newer migrants are for the time being finding work in the informal services sector—a fact that explains why NRM group three and four are the most urban, land-poor and youngest group in the community. The practice of land-borrowing/lending is both evidence of land inequities and the community's attempt to reconcile the uneven distribution of resources.

New opportunities to earn urban income in Carvão coupled with diminishing opportunities in rural industries have prompted shifts in natural resource management and consumption practices. On the level of the community, livelihood change can be summarized as the replacement of farm income for urban income, and shifts in consumption patterns—where families today purchase the majority of food that comes into the household. Despite movements away from a rural-based livelihood, Carvão residents still participate in rural activities, and because of the large percentage of residents who still farm, many self-identify as farmers and are adamant about the importance of natural resource management to their families' survival.

The economic history of Carvão outlined in Chapter Five illustrates that residents have long shifted between major livelihood activities, generally modifying commercial production to meet outside market demands. The history also reveals that residents have consistently reinvented themselves to take advantage of new economic opportunities. The recent period of economic change described here represents another phase in this long history. At the same time however, recent shifts are unique in the following ways: 1) In the past, residents have transitioned between different rural market-based activities and 2) today, a majority of residents earn a stable monthly income—whereas in the past, cash earned through marketing rural products varied greatly from month to month. The latter change has implications for how residents manage natural resources in the study site.

The economic changes occurring since the late 1980s have up to this point been portrayed in a somewhat positive light, as I have stressed that in contrast to the past, Carvão residents today have more opportunities to earn income. However, within Carvão today there are varying opinions as to whether or not the quality of life has improved over the past 15 years. Many elderly residents say that poverty (and poor people defined as those with few material possessions) no longer exist in Carvão. In their view, hunger in winter months, when fish and game are more difficult to capture, has diminished and the government pays you just for "getting old" (stated in reference to the rural workers union pensions). On the other hand, younger residents more commonly say that life is difficult, and that the future holds little economic opportunity. As the previous discussion indicates, both groups are correct; in Carvão various resources exist, which form a blanket of security protecting residents from severe hunger. At the same time, however, the economy of Carvão has reached a critical point. At the time of research, there were

few vacancies in public positions. In the last round of hiring for public schools, not one Mazagão resident was hired due to tough competition from across the state. Because regional *bolsa* quotas have already been surpassed, there are waiting lists for public assistance. Furthermore, industrial growth in the area has retreated over the past decade in Amapá and offers no immediate hope for employment creation. As the population continues to grow it is imperative that residents look for additional means to sustain their families.

In light of this precarious economic situation, local families are looking again toward agricultural production as a way to generate needed income. In particular, production geared toward the expanding urban population in Mazagão and in the greater Macapá region offers a potential means of generating cash. In Carvão and the nearby cities of Mazagão Novo, Santana, and Macapá there are unmet demands for fruits, vegetables, and protein sources—all of which can be grown in the community often in house lots, to which all Carvão residents have access. Moreover, dedication to rural development is even more crucial as the community contends with diminishing fish and game stocks and a stagnant economy. With natural protein becoming scarce, residents must either be able to purchase it or raise their own food, which, in turn, depends on the ability to generate income for investment in farm-based animal husbandry. Finally, the potential shift back to a rural-based livelihood would be consistent with the long history of continual and unpredictable economic change in Carvão and would indicate that observed changes in Carvão are neither deterministic nor unidirectional.

CHAPTER SEVEN: A Community in Transition: Economic Strategies in Mutuacá, Brazil

Introduction

As compared to Carvão, the várzea community of Mutuacá, scattered over the muddy banks of a fast flowing river, seemed on first impression more rural in nature. The houses in this settlement mainly wooden, raised on stilts, and accompanied by canoe-landing platforms made out of buritĺ[131] palms, gave the place a bucolic feel. Over the past fifteen years, however, economic patterns and daily life had has changed in Mutuacá, and almost immediately I became aware of similar colliding images of rural and urban life. In the early mornings, when the waters are high enough, women set off in wooden canoes to collect or set out fish baskets called matapí woven from palm fibers a technology derived from indigenous groups in the region. Other mornings on the other hand women will dress in their urban clothing and head to Carvão—where they catch a bus to Mazagão Novo and to Macapá to shop or collect welfare or retirement payments using a debit card linked to a national financial institutions. On these days women will bring home news of national political scandals and gossip about pop stars, and later be confronted again with the local reality—one of working in the forests, on the rivers and in agricultural fields.

This chapter presents the second case study in this dissertation and examines both demographic and economic changes in the várzea community of Mutuacá, and attempts to grapple with some of the complexities of daily life described above. The chapter is organized into two main sections. Following this introduction the first section provides background information on the community, describing its physical layout, community

[131] *Mauritia flexuosa*

infrastructure, and demographic patterns. I also describe the nature of growth in Carvão examining—who is moving to the community, from where migrants are arriving, and why they have chosen to settle in the community. Results from household economic surveys indicate that as compared to Carvão, growth in Mutuacá is occurring on a smaller scale; and that Mutuacá public services and community-level infrastructure remain even more precarious. Just as in Carvão, Mutuacá is growing as a result of migration to the community by caboclos from nearby várzea communities, and that migration into the community has resulted in a diverse community made-up of disjointed kin groups.

The second part of the chapter describes the economy of Mutuacá, examining landholding patterns and the activities with which residents engage to make a living. Data reveal that in recent years, residents have incorporated urban resources into a rural-based livelihood system. Mutuacá residents earn income from the public sector in the form of wages, pensions, and welfare payments and from daily wages from an informal services sector. As compared to Carvão however the urban economy in Mutuacá is modest. Only three residents have government jobs; however all but four households out of seventeen have access to either a retirement pension or welfare payment; as compared to Carvão, the average stable income earned is low R$300 (as opposed to R$621). [132] On the other hand, Mutuacá has a much more active rural economy, where all but two residents sell rural products at least occasionally. The sale of açaí fruits and freshwater shrimp are the most important rural commercial activities; in particular, açaí provides a great source of potential rural income in Mutuacá—and most families are investing in this activity.

[132] The Brazilian Real in 2005 vacillated between R$2.4 to 2.1 to 1US$. The current, October 2007, value is R$1.8 to 1US$.

The results from economic surveys thus suggest that in both Carvão and Mutuacá residents have hybrid livelihood; in both communities residents piece together urban and rural resource, and rely upon extended kin and patron-client relationships to increase economic security. Due to increased cash circulation in both communities, residents today consume more store-bought foods—a move that has decreased local dependence on fish and game stocks to meet community food needs. While there is a similarity in the general structure of livelihoods and consumption patterns, the role of urban and rural activities in each location differs. In Carvão, urban income is the primary source of cash earnings whereas in Mutuacá, residents use urban income to supplement earnings from the sale of rural products. In Carvão, families have shifted away from commercial agriculture in part because farmers have lost markets for manioc products. On the other hand, Mutuacá farmers are benefiting from increased demand for açaí and shrimp demanded by the growing urban population in the greater Macapá region. In the várzea, agricultural change is characterized by the conversion of large areas to açaí-dominated forests, where today açaí is being planted to the exclusion of other crops. Changing demand for these specific products impacted local perceptions of the economy. Whereas in Mutuacá, residents are generally optimistic about their future earning potential, in Carvão residents are searching for innovative solutions to a stagnant economy.

Finally, the chapter concludes by discussing how economic patterns observed in Carvão and Mutuacá compares to those described in the larger ethnographic literature on caboclos. In contrast to the wider literature, in Carvão and Mutuacá, we see that economic patterns have become even more complex, as residents combine new resources into a rural based livelihood system. In addition, whereas recent ethnographers discuss

the use of migration to urban centers as a way for caboclos to access urban resources (Cleary 1993, Nugent 1993), the case of Carvão and Mutuacá presents a different scenario. Because of wider social and political change occurring over the past 15 years, to access resource residents do not need to migrate to cities, but can continue to live in their community. Moreover, to access these new resources, residents have had to acquire new skills and knowledge of urban institutions, geography and government bureaucracies. In some cases, residents have had to reinvent themselves as wage laborers or government employees. In this process of change, we observe characteristics of flexibility and opportunism—traits that have long allowed caboclos to access resources in a dynamic social and natural environment.

Study Site

Physical Layout of Mutuacá

The Mutuacá River is one of five rivers in an area known as Foz de Mazagão and flows into the wider Mazagão River that eventually runs into the main channel of the Amazon (Figure 7.1-7.2). The community of the same name is scattered over the banks of the river and is made up of approximately 25 houses with a population of 175 (with a mean household size of seven people per dwelling place) (Table 7.1).[133] In contrast to Carvão which has the structure of a village with public buildings and various gathering places—aside from a two-room, wooden elementary school (where children in grades one through four study) there are no public buildings in Mutuacá and all houses and structures in Mutuacá are wooden, as the water-logged várzea soils cannot support the weight of

[133] These estimates are conservative as household size figures do not include family members working outside of the community.

cement buildings).[134] In 2007, there were however a few locally-run businesses. Two residents were selling basic provisions from their homes. I also counted four sawmills—which for a small community is a sizable number; however, residents living in the community for at least 15 years recall a time when up to 18 mills were operating in Mutuacá. In addition to the stores and mills, two men have established make-shift shops under palm thatched pavilions where they construct large wooden boats and fix motors of various sorts.

Table 7.1. Summary of demographic trends, Mutuacá, Brazil, 2007 (Results found in 17 household economic surveys).

Variable	**Statistic**		
	Mean	**Median**	**Range**
Household size (no. individuals in/home**)**	7.12	8	11
Residency in Mutuacá (no. of yrs.)	12	10	30
Total Area of landholdings (ha)	49	45	98.75
Stable monthly income (R$)	302.3	300	531

[134] To complete primary school, students travel to Carvão and study at the school in the vila or to the elementary school located along the Mazagão River; after elementary school, a select number of students will study at the EFAC or will live with relatives in urban centers in Amapá.

Figure 7.1. Map showing the study communities, Carvão and Mutuacá, and the five rivers of the Foz de Mazagão, state of Amapá, Brazil.

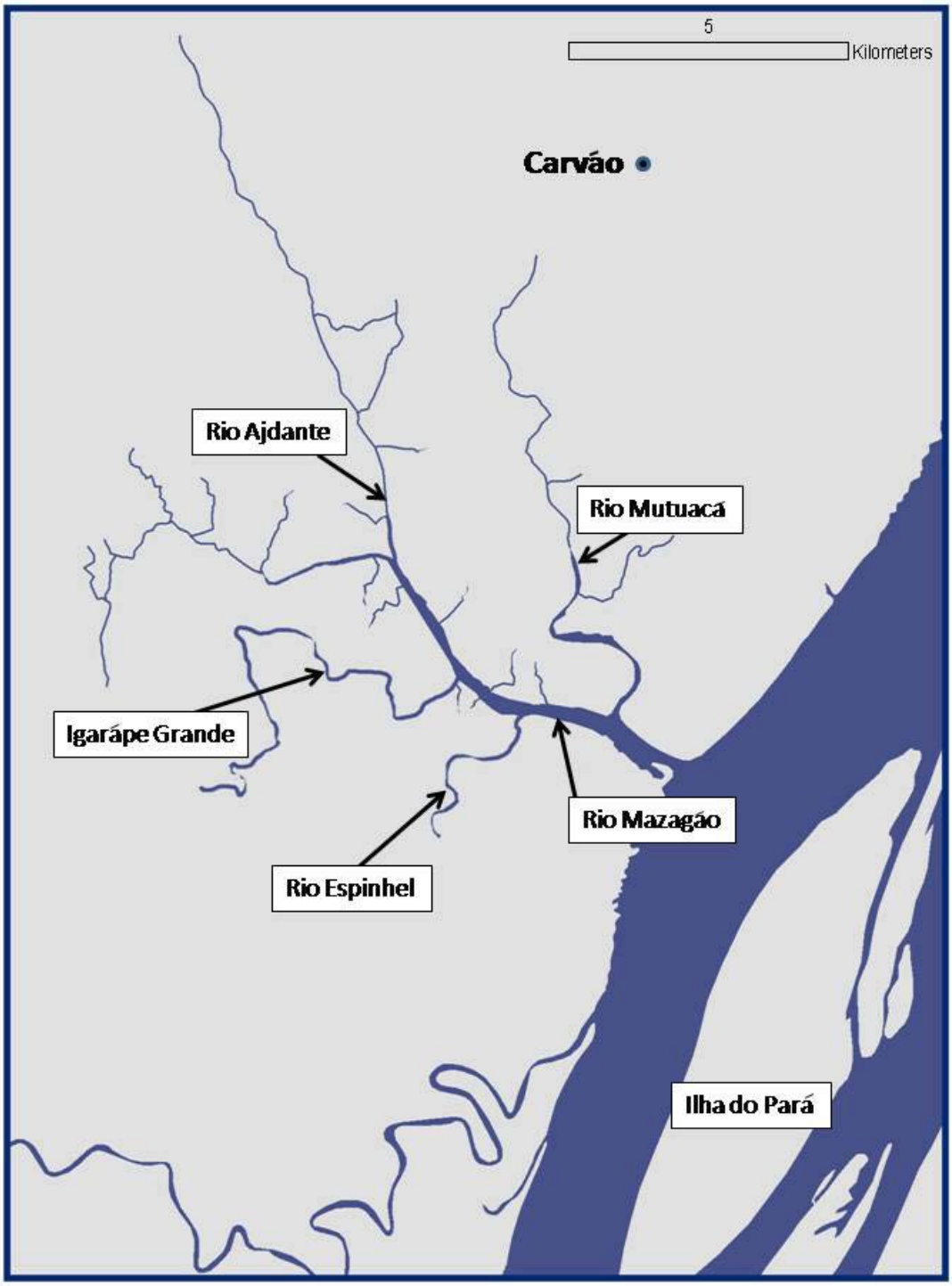


Figure 7.2. Map showing the riverine settlement of Mutuacá in relation to the Amazon River, Brazil.

Water and transportation

In contrast to Carvão, no public water distribution system exists in Mutuacá. While a select number of families use electric motors to pump water from the river to their homes, most families gather water from the river. Residents plan domestic chores around the movement of the diurnal tides. At high tide (*agua grande*) when water has reached the height of trapiches and buritί platforms, residents bathe, wash clothing, and fill up buckets stored in kitchen areas for domestic use. In addition, the unique flooded environment restricts transportation to waterways and flooded forest pathways that are impassable during the rainy season when flood waters reach the forests. Residents primarily use canoes to travel within Mutuacá, to the Queimada in Carvão, and to other nearby settlements in the Foz de Mazagão. To travel greater distances, generally to the city of Santana to market forest products or for monthly shopping trips, families use motorized boats; families without their own boats arrange to travel to the city with neighbors or relatives.

Electricity

In 2002, residents from the Foz de Mazagão gathered together to clear areas of forest to make room for power lines installed later that year by the state electric company. By 2005, all the homes I visited in Mutuacá had electricity, and most residents were also enrolled in the state energy program that covers residential energy costs. Like in Carvão, electric infrastructure is poor, and in the várzea where tree density is higher, outages are even more frequent during the rainy season. Because Mutuacá is more isolated than surrounding upland communities, power takes even longer to restore. Nevertheless all residents agree that the arrival of energy has improved the quality of life in the

community. Shortly after installation, many families bought freezers that have enabled residents to store perishable foods, especially hunted fish and game (previously salted for preservation). Residents also purchased television sets and because reception is poor on the rivers, parabolic antennas, and thus today feel more connected to the outside world.[135]

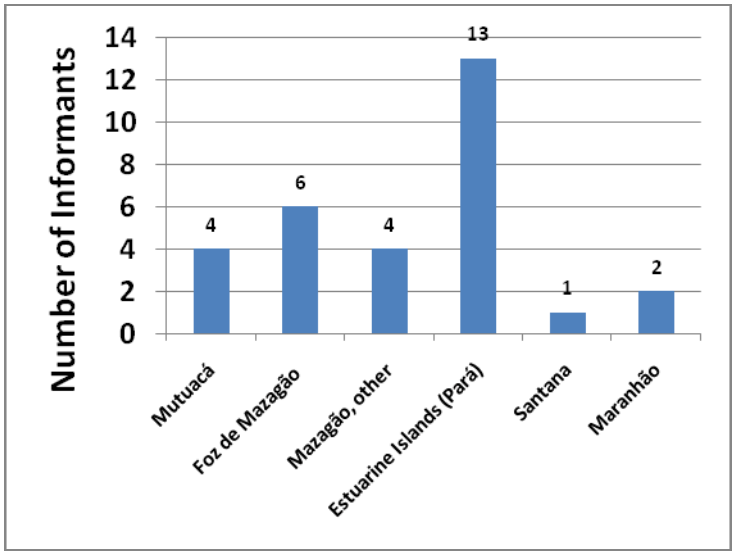
Demographic Patterns

Data from household economic surveys conducted in 2007 indicate that most Mutuacá residents have lived in the community for less than 15 years (Table 7.1). Data also indicate that out of 24 individuals only three were born in Mutuacá (Figure 6.3). Together these data indicate that the population is in flux. Based on long-time residents' testimonies, it appears that the local population has expanded in recent years. Residents describe a time when there were very few houses along the riverbanks. Today, however, the area is described as "full" (*cheia*) and residents worry that already diminishing fish and game stocks will completely disappear. Like in Carvão, the recent expansion of Mutuacá is attributed to both the growth of the preexisting population—which is seen in the expanding house clusters belonging to groups of extended kin—and to migration of caboclos from nearby várzea communities. For instance, birthplace data indicate that that most informants are living with 300 km for where they were born, and all but two residents (out of 30) identified as ribeirinhos from similar floodplain zones (Table 7.1). Growth in Mutuacá, as compared to Carvão, is limited by the geography of the floodplain, where building is confined to the riverbanks—the highest areas of land (called

[135] Most families also have radios that have long played an important role in regional communication for várzea residents. The local radio station in Macapá has a program that "passes" messages from urban relatives to their kin in the countryside.

the *tesoura* or *restinga* or more simply the *terra alta*) that escape daily flooding during the summer months.

Figure 7.3. Graph showing birthplace of informants in Mutuacá (results found in 24 interviews). "Mazagão, other" refers to communities located in the municipality outside of the Foz de Mazagão.



Characteristics of local migration

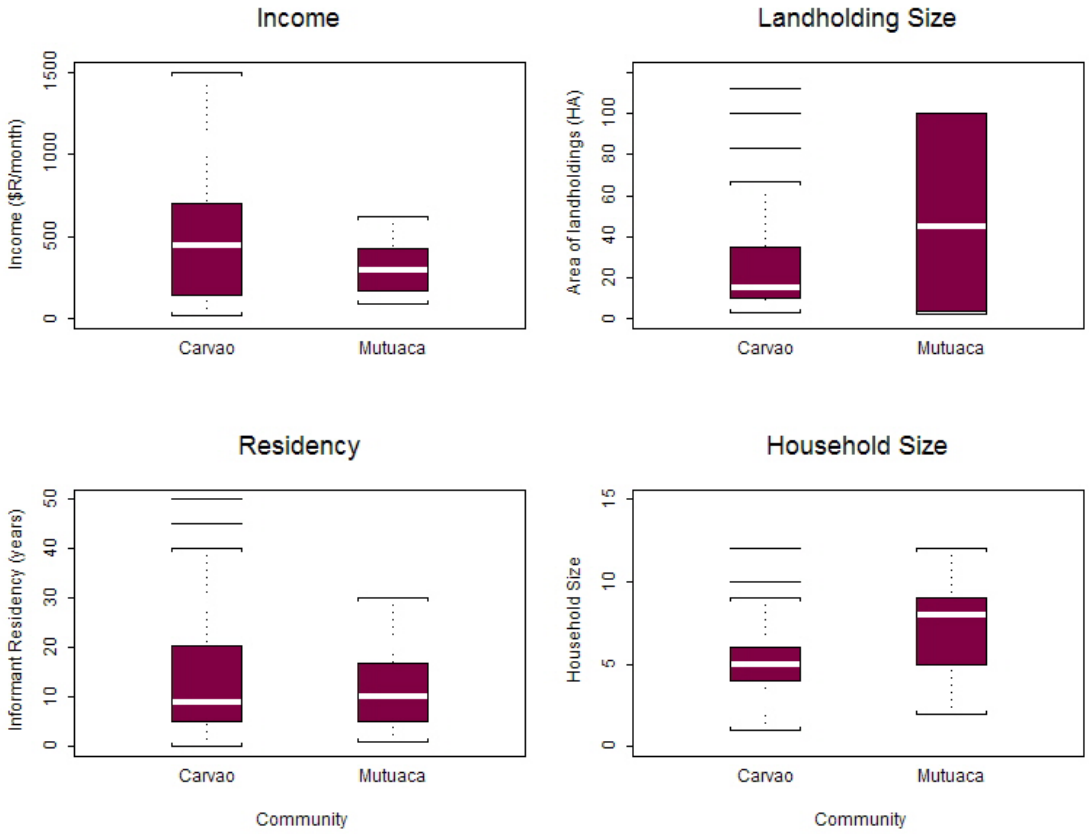
Data from household surveys reveals that residents who migrated to Mutuacá within the past five years moved from diverse places, including Rio Preto (in the municipality of Mazagão), the Foz de Mazagão, rural communities in state of Maranhão (that lies to the south of Amapá), and the nearby city of Santana in Amapá. In contrast to Carvão, where many families cited practical reasons for settling in the community (i.e. to be closer to schools and urban resources), in Mutuacá individuals' motives were personal. Some married into local families while others came to the region in search of land for farming—in particular to engage in the açaí trade. One female informant recalls that she "discovered" Mutuacá while attending a party along the Mazagão River. At the party, she

met her husband and a month later moved to Mutuacá where she lives in a house next to her husband's parents. A male informant, named Mario said that he came to Macapá to hoping to start a small business. In the city, he acquired a boat and began a short career as a fluvial trader. During this time, he sold goods to residents in the Foz de Mazagão, made friends with a family in Mutuacá, and married one a young woman from the community. In 2006, he bought a small property, sold the last of his goods, and began to plant açaí. In 2007, I also met Jaime and Célia, siblings, originally from Afua, Pará, who live in separate house lots along the river. Jaime and Célia separately made their way to the city of Santana in their adult lives. Here Jaime met a relative of Sr. Juan (the old owner of the sawmill Mazagente). Jaime was hired by Juan's family as a casiero to prevent outsiders from using anymore of his land. Finding the community agreeable and with economic potential, Jaime invited Célia, her husband, and their two children to live on the opposite side of Juan's property. Both families are investing in açaí and other economic fruits, and ironically working with INCRA to secure land rights to the areas of land surrounding their homes.

In summary, Mutuacá like Carvão is experiencing change in its demographic structure as new migrants to the area continue to move to the community both for personal, social and economic reasons. Today Mutuacá is a rural community that feels increasingly more urban, and where residents contend with the question of how to manage natural resources in an area experiencing population growth. Having described the physical layout of the community, its demographic structure and the nature of community infrastructure, this chapter now moves on to examine local economic patterns. This discussion builds on chapter four and represents another period in a long

history of economic change – and can be read in parallel to the discussion of Carvão's economy. Figure 7.4 compares the means of four socio-economic variables as calculated for Carvão and Mutuacá. Results from analysis of variance tests (ANOVA) show a close to significant difference between the mean landholding size (ha) and stable income levels in both communities (with p-vales of 0.08 and 0.081 respectively). The results also show a very significant result for household size with a p-value of 0.000548.

Figure 7.4. Box-plots comparing the median values of four socio-economic indicators between Carvão and Mutuacá.



Making a Living in Mutuacá

Landholding patterns

In contrast to Carvão residents, all informants interviewed in Mutuacá reported having access to areas to areas for rural production (Table 7.2). In some cases, large extended families share the same piece of property. In one case four families with 23 people share 40 ha of land. In another, three nuclear families with 25 people in total share 50 ha of land. Heads of households currently living and sharing land in these larger clusters are looking for lands along nearby tributaries along Mutuacá to manage for açaí. Some have invaded areas along the igarapé de Mirim lands that once belonged to Juan. Mutuacá residents generally live on the same property managed for natural resources, and in most cases, the land extends behind their houses (and the riverbanks) into the várzea forests. Data from household economic surveys indicate a mean landholding size of 35 ha (Table 7.1) and a range in landholding size from 2.25 to 100 ha indicating that land is unevenly distributed between households in the community.

Moreover, research reveals that residents invaded, inherited or "purchased" their lands. In the latter case, many traded motors or large objects of values (freezers) in exchange for land. Most residents who "bought" their land have receipts of purchase which many times are mistaken as legal documents, granting land rights to the new owners. Two landowners in Mutuacá claim to have legal titles to their lands, and another farmer is in the process of applying for legal tenure. Two other families have documents of *possee* and the remaining families have no documentation of their families land. However, these areas are publically recognized as belonging to the family (Table 7.2). In the várzea, igarapés that dissect the properties are often used to mark lines of division

between adjacent properties. Up to this point, residents do not report major land conflicts, such as outright invasion and squatting; however, petty theft of crops is very common in Mutuacá.

Table 7.2. Summary of demographic trends II, Mutuacá, Brazil, 2007.

Demographic trends	**Yes**	**No**
Rural background (n=32)	30 (93.3%)	2 (6.6%)
Born in Mazagão (county) (n=30)	14 (47%)	16 (53%)
Demographic trends (n=17)		
Permanent access to land	17 (100%)	0
Legal tenure	2 (88.2%)	15 (11.8%)
Stable monthly income	13 (75.5%)	4 (23.5%)
Cultivate annual/perennial crops in at least two production areas	17 (100%)	0
Sell rural products (at least occasionally)	15 (88%)	2 (12%)
Engage in rural activities	17 (100%)	0

The Urban Economy of Mutuacá

As compared to Carvão, Mutuacá has a much more active rural economy. Results from the 2007 household economic survey indicate that all families engage in at least one rural subsistence activity, and that 15 or 88% of all interviewees sell at least one type of rural product at least occasionally (Table 7.2). At the same time, 16 families (94% of those interviewed) also receive income from government sources—13 of whom receive income on a monthly basis (Table 7.2). Like residents in Carvão, in Mutuacá families earn stable monthly income from state, federal and municipal governments both in the form of wages and pensions (Tables 6.3 and 6.4). The range in income received per month is much smaller in Mutuacá than in Carvão—calculated at R$530 (with as residents earning from $R90 to $6R620 per month), as compared to R$2575 (R$25 to R$2600) in Carvão. Likewise, the mean stable income in Mutuacá is R$301 about half the mean income value in Carvão.

Government Income

Three residents out of 17 households in Mutuacá were found to be employed by state government of Amapá (there are no federal or municipal-level government workers in Mutuacá). Two men reported to work as "school boat drivers," transporting students to and from the school in Mutuacá. Each are paid $R500 a month from which they must also maintain their boats. The other state employee worked as a school cook preparing students' mid-morning meal (*merenda*). [136] In addition, families receive payments from

[136] Children are served a meal in the late morning around 10 AM. Under President Lula, the federal government began distributing more funds to states and municipalities to improve the school lunch program. As another reform, school administrators should buy products from local famers. However, the success of these programs and initiatives often depends on local capacity. The director of the main elementary school Carvão recognizes the importance of the school lunch program to poor families in the

four different welfare programs and from two different types of pensions (Table 7. 3). Three families in the sample earn seasonal payments of $350/month from the fishermen's union (colonia de casca/pesca). The organization grants money to families during fish spawning months when their capture is prohibited. The income is meant to defray extra food costs incurred by families during these months. Because families only earn these payments for three months out of the year, I excluded this from the monthly income average values (Table 7.1).

Table 7.3. Sources of government (stable income) in Mutuacá, Brazil, 2007.

State government, wages	**Total**	**State government, payments**	**Total**	**Federal, payments**	**Total**	**Municipal government, payments**	**Total**
	3		5		9		2
Occupation		**Program**		**Program**		**Program**	
School cook, Mutuacá	1	Bolsa viver melhor	2	Bolsa família	2	Bolsa (general)	2
School transportation, Mutuacá	2	Colonia de caça/pesca	3	Bolsa escola	1		
				Retirement pension	4		
				Disability pension	2		

community, and makes a point to serve hot meals at least four times a week. She also makes an effort to buy fruit and pulp produced by farmers Carvão and Mutuacá.

The informal urban economy

In addition to government income, seven families earn income from informal services or from family-owned (non-rural) businesses (Table 7.4). Four informants reported earning money through daily wages earned working on others properties in the Foz de Mazagão Velho. As in Carvão, residents earn from R$12 to R$15 per day, and in the case of Mutuacá, most day laborers reported to work in açaízais, planting seedlings and/or thinning stands. In addition, one informant replied that he earns income by occasionally repairing motors dropped off at his house. Two families earn cash by selling groceries from home, and another two men earn cash by constructing large wooden boats on a contract basis. In both cases, the men reported to earn little money—about R$200 a month (if the income were spread out over the year).

Table 7.4. Informal economy: Sources of income and informants per category Mutuacá, Brazil, 2007 (n=17).

Informal service sector wages	**Total per Category**	**Local businesses**	**Total per Category**
	5	4	
Occupations		**Types**	
Agricultural day, laborer	4	Grocery stores	2
Mechanic, day laborer	1	Sawmills	2
		Boat construction	2

The Rural Economy of Mutuacá

Commercial production

Residents combine cash income from government sources and the informal economy with diverse rural activities recorded on Table 7.5. Between commercial and subsistence activities, families participated in seven main types of production activities—including, the production of annual crops, small animal husbandry, the extraction of fish and shrimp from rivers and streams, and managing plant species for tropical fruits and timber. In Mutuacá açaí is the most commonly marketed product, with 10 families currently selling the fruits, and another augmenting native açaí stands on their properties (Table 7.5). The collection of freshwater shrimp from várzea waters was the second most common commercial activity—with seven families reporting to sell shrimp at least occasionally. Timber and fruit production (other than açaí) in managed forests and home gardens were also important commercial activities. Finally, one resident reported to be a commercial fisherman, travelling to the main channel of the Amazon and selling fish to residents in the Foz de Mazagão and also in Santana.

Table 7.5. Rural production activities in Mutuacá, Brazil, 2007.

Activity	Total number of households participating	Number of households engaging in commercial production
Management of açaí	**11**	**10**
Perennial fruit cultivation/home gardens (other than açaí)	**6**	**3**
Cultivation of annual crops	**11**	**4**
Extraction of shrimp	**12**	**7**
Management of timber	**5**	**5**
Fishing	**16**	**1**
Hunting	**2**	**2**

The local açaí trade

Rural producers in Mutuacá have over the past ten years benefited from the soaring demand for açaí fruits (for the production of *vinho*) in local urban centers such as Santana and Macapá, but also in smaller cities like Carvão and Mazagão Novo.[137] Increasing demand for açaí is attributed in large part to the expansion of local cities from migration by rural residents accustomed to eating açaí as a dietary staple in the interior regions of the state (Hiraoka 1994, Murrieta et al. 1999, Brondizio et al. 2002). Families in Mutuacá often describe açaí as the new *garimpo* (gold), and report that no other product sells better in the region. Producers in Mutuacá sell açaí fruits to middlemen in Santana by way of an informal contract, or more commonly to traders (called *açaízeiros* of

[137] As discussed in Chapter Three, the açaí boom in Amapá is part of a larger phenomenon occurring in Amazonia linked to the expansion of rural cities in the region, but also to increasing national and international demand for açaí, which is being marketed as a health (or fashion) food and consumed by urbanites in Brazil, Europe, and the United States. See Brondizio et al. (2002) for a history of this process.

atravesadores) who come to residents homes during the açaí season (roughly from July to December[138]) to purchase açaí. Açaí traders generally work on an informal contract basis, collecting açaí from one to three times a week, and buying fruits by the sack, equivalent to 60 kilos. Over the course of the year, the price for açaí vacillates in accordance to local supply, ranging from $R10/sack during peak supply and $R40 toward the end of the season. Because of the importance of the açaí trade to household economies, the price of açaí—or what the fruit is selling for in Santana—is a common topic of discussion in Mutuacá; residents bring this knowledge back to the community from their frequent trips to the city. Community knowledge of daily price fluctuations prevents producers from being cheated by açaí traders—a fear common in Amazonia due to reputation as deceitful tricksters, a reputation that goes back to the days aviamento (McGrath 1999; 2000). For the most part, açaí traders in Mutuacá live locally or relatives of community members and considered trustworthy. Both producers and traders expressed a mutual dependence on one another.

Despite the importance of açaí to the local economy, only four açaí producers (out of 11) interviewed in Mutuacá were able to provide estimates for the volume (or weight) of açaí sold over the course a season. The range of these figures was great, with families selling 22, 150, 180 and 400 sacks of açaí per season.[139] Because the price of açaí fluctuates greatly over the course of the year, it was not possible to calculate average monthly or seasonal earning for these families. Five families (who did not provide

[138] Through management techniques described in Chapter Three Mutuacá, farmers have extended the "natural" fruiting cycle of açaí, and in some cases, families now have açaí coming into fruit over the entire year; outside of the season however yields are low and thus farmers have only enough to meet their own consumption needs.

[139] Research by Jardim and Anderson (1987) estimated açaí output production to be 13,90kg/ha/yr in managed forests, where one ha had between 131 and 200 clumps/ha.

estimates volume of sale) reported to sell "very little" açaí, as they were still investing in the enterprise—planting açaí on their properties and thinning native açaí stands to increase yields. Two of these five families were in transition from being timber producers to açaí farmers, a change that demands replanting exploited várzea forests with açaí and other complementary fruits. The three other producers in this group were recent migrants, settling within the region in the last six years. All three of these producers acquired properties where timber and entire açaí palms (for heart of palm [*palmito*]) have been exploited for a number of years. [140] These residents are also planting açaí throughout their lands. In 2007 there were selling occasionally—only during peak season when production exceeds their families' consumption needs. Finally, one family with access to just 2.25 ha of land plants and manages açaí for subsistence purpose.

Other commercial fruit production

In addition to the production of açaí, families in Mutuacá also produce a diversity of fruits, vegetables, and herbs in their home gardens.[141]All families maintain home gardens that vary considerably both in size and composition. However, várzea gardens usually contain three separate areas: 1) an area of vegetable and herb production (often in multiple raised boxes usually off the kitchen or near the trapiche 2) an area dominated by the production of mixed tropical fruits, and 3) açaí-dominated orchards which are planted with açaí and often shade tolerant commercial fruit species such as cupuaçu (*Theobroma*

[140] Açaí palm stems are harvested for heart of palm (*palmito*), another importance economic commodity in the region. Because açaí fruits gain a higher market price, farmers in Mutuacá today rarely harvest açaí for heart of palm. When the açaí fruit season is coming to an end, however, smallholders may cut down taller açaí palms, from which fruits are difficult to collect and sell the stems. When farmers plan to leave their properties however they will often cut down large areas of açaí to sell the stems for palmito—which was the case with two properties that I visited in Mutuacá in 2007.

[141] Chapter Three contains a discussion of the agrobiodiversity of home gardens.

grandiflora) and cacao (*T. cacao*). Three interviewees reported to sell the pulp of cupuaçu, graviola (*Annona muricata*) and taperebá (*Spondias mombin*) on informal basis when the fruits are in season. Farmers tend to market these crops locally selling the pulp to area schools for use in the lunch program or to individual consumers in the community, in Carvão. When traveling to Santana for a different purpose, residents might bring fruit or pulp to sell to a willing buyer. Like in Carvão, families sometimes use sporadic income earned to purchase large items for the houses. In 2006, for instance a woman from Mutuacá told me that she purchased a new television antenna with money earned from cupuaçu pulp (worth approximately R$300).

The collection of freshwater shrimp

The collection of shrimp is a seasonal activity conducted in the summer months when shrimp are easier to catch; during the winter, flood waters carry the animals into forest streams. Shrimp collection is also largely considered women's work. To catch freshwater shrimp, residents use a technology common in the region, which is likely of Amerindian origin (Smith 2002). Freshwater shrimp are captured in woven cylindrical baskets (called *matapí*) strung together on a line, and placed in the shallow waters of the tidal várzea. Matapi have coned entrances that protrude inward at both ends that trap the fish inside. Before setting out the baskets out in the early mornings, residents place crushed up babasu palm (*Orbignya phalerata*) fruits rolled into a ball using banana leaves (*Musa* sp.) or leaves from *Heliconia* sp. to prevent them from dissolving in the water. The baskets are generally left out for a day, checked the next, and retrieved when they are full of shrimp. Residents later empty shrimp into wooden boxes that serve as temporary holding tanks called *viveiros*. With shrimp successfully in the *viveiro*, women extract a portion of

the catch for household consumption, and set out to find a buyer the rest of the catch. In comparison to açaí, residents must market shrimp themselves, as no middlemen deal in the shrimp trade. Residents sell shrimp to buyers who come directly to their homes or most often travel to nearby towns and cities to sell their catch. Some residents maintain regular clients in Santana. Others try their luck and sell to willing buyers who appear in the port. Residents reserve larger quantities of shrimp to sell during holiday periods, especially in July, November and December when religious festivals in Mazagão Velho and Carvão attract hundreds of people.

In recent years, the extraction of shrimp from area waterways has increased since 2004 when the women's association of the Foz de Mazagão Velho (*Associação das Mulheres da Foz de Mazagão*) obtained money to purchase and distribute matapi to their members. Five women interviewed in this study received matapi (30 apiece), which enabled them to increase their yields.[142] In 2006, associated women were able to sell shrimp at a rate of R$4 per kilo to a buyer contracted by the group to purchase shrimp from Mazagão for the season.

Timber production

Two families in the sample reported to own and operate saw mills in Mutuacá. Three other families reported to occasionally sell timber from their properties to meet unexpected expenses or as part the process of preparing agricultural fields, which occasionally involves removing timber species. The owners of sawmills interviewed in this study reported to process timber from their own properties and to harvest timber from

[142] The president of the women's association estimates that women capture 70 kilos of shrimp/month with 30 matapi.

other properties in the Foz de Mazagão. In the latter case, timber is either "turned in" and sold to the mill owners by the property owners themselves (in which case the profits for the producer are greater) or the property owners permits employees of the mill to extract timber from his land. Owners of the mill either pay families in cash, or give the owner half of the boards produced from the timber, or finally in a system reminiscent of aviamento, exchange the timber for groceries. Because the trade is not completely monetized, sawmill owners and residents selling their wood could not provide estimates of how much they earned from the timber trade. Table 7.7 displays a list of common commercial timber species in the greater Mutuacá region.

Table 7.7. Timber Species commonly managed (planted and conserved in forests, fallows and home gardens) in the Foz de Mazagão, Brazil (Source: Pinedo-Vasquez et al. 2001).

Scientific Name of Common Timber Species
Aniba amazonica
Belluccia sp.
Callycophyllum spruceanum
Calophyllum brasilensis
Campsiandra laurifolia
Carapa guianensis
Cedrela odorata
Ceiba pentandra
Clinostemon mahuba
Connarus sp.
Couratari guianensis
Ficus sp.
Guara sessiflora
Gustavia augusta
Hernandia guianensis
Hura crepitans
Licania heteromorpha
Maquira coreacea
Mora paraensis
Mouriri glandifolia
Ormosia sp.
Pentachletra macrolloba
Platymiscium huberi
Platymiscium huberi
Pouteria sp.
Protium sp.
Pseudolmedia maxima
Pteroçarpus amazonico
Saccoglottis guianensis
Siparuma guianensis
Sterculia speciosa
Swartzia acuminata
Swartzia racemosa
Symphonia globulifera
Tabebuia sp.
Virola surinamensis
Xylopia sp.

Rural Subsistence Activities

Farming

In addition to açaízais and home gardens, a limited number of farmers plant annual, semi-annual and perennial crops, such as corn, squash, sugarcane, and bananas in fields planted in December 2006 or early 2007. As the results from agrobiodiversity surveys presented in Chapter Three demonstrate, only four fields out of 17 properties remained were identified. These fields were monocultures of corn or beans. While two families said they planted corn as feed for ducks and chickens, for the most part, annual fields were prepared as a step in the conversion process of mixed várzea forests to açaí-dominated stands. Cultivated açaí (transplanted from the forest) generally begins to produce fruit after three years. Thus to profit from the land while açaí is growing, farmers often plant and harvest annual crops for two years around açaí seedlings. Crops such as corn are said to facilitate the growth of açaí seedling that shade the seedlings. While farmers explained that they primarily plant for subsistence purposes, they will occasionally sell crops to neighbors on the search for a particular vegetable – or looking to buy feed for animals when their own stocks run low.

In addition, few Mutuacá residents (3 out of 17) reported to engage in small animal husbandry. Some residents explained that they were not raising animals as pigs, ducks, and chickens because animals destroy young plants. However, residents often replied that in the future with more disposable income, they would consider investing in animals and fencing that would allow them to elaborate both small animal husbandry and cultivation activities.

Fishing and Hunting

Results from household economic surveys indicate that fishing is the most important subsistence activity in Mutuacá. Sixteen families (94%) reported to fish regularly to bring in food to the household (Table 7.5). Families most commonly catch fish with large nets set across rivers and streams of the várzea. This technology takes advantage of rising tides that carry fish into the nets with the movement of the currents. Residents generally catch a suite of fish called *peixe de beira,* which are small fish caught of Amazonian tributaries and igarapés as opposed to larger fish of the larger rivers of the basin. Some of the most common fish include: *dourada* (*Brachyplatystoma flavicans*), *tambaqui* (*Colossoma macropompmum*) and *traíra* (*Hoplias malabaricus*). In addition, a limited number of informants (2 out of 17) reported to hunt as a means of securing food (Table 7.5). Based on my observations, small game, including mammals and reptiles are hunted upon opportunity when residents come across them in the forest often elaborating a different activity. Animals important to the regional diet include: species of caiman and turtle, the iguana (*Iguana iguana*), cutia and paca.

Consumption Patterns

Families' consumption patterns in Mutuacá low a seasonal pattern. During the summer months, residents primarily eat fish, shrimp, or game meat hunted from the forest with açaí and farinha as primary meals. During the winter months, when the flood water carry fish and shrimp into the forests of the estuary, families purchase more urban foods, such as frozen chicken or meat bought in the cities of Santana or Mazagão Velho. When families are no longer producing açaí, as the natural crop cycle runs from July to

December they report feeling more hungry[143] and supplement their diet with rice and beans. They may also eat more frequently, eating mid-morning or afternoon snacks of gruels made of banana and farinha to stave off hunger throughout the day. Throughout the year, residents especially children will eat the various fruits in season cultivated in their home gardens between meals.

Because there are no large stores to purchase food in quantity in Mutuacá, residents either buy groceries in Mazagão Novo or Santana either monthly or bi-monthly. Residents who receive welfare payments or retirement pensions in Mazagão Novo will often purchase food after receiving their payments. Families who sell forest and products in Santana purchase food in the port city, where prices generally tend to be lower. When residents run out of food in the middle of the month they might buy food on credit at Lucimar's, a store operating at the mouth of Igarapé Grande in the Foz de Mazagão. Sometimes residents purchase goods from fluvial traders, selling at higher prices to várzea residents. In 2007, a trader from Santana was selling meat to residents in Foz and was reportedly charging a fair price. Like in Carvão, within the Foz residents often extended informal credit and in some cases residents can buy food fiado from fluvial traders. The ability to buy food on credit locally has increased food security especially during the winter months.

In summary, the results from household economic surveys thus indicate that Mutuacá residents have access to diverse resource, including public salaries, payments, pensions, and the informal economy. Data indicate that a majority of households have

[143] Nutritional studies on açaí have shown that the fruit is an important source of iron in the *ribierinho* diet (Murrieta 1994, Brondizio and Siquiera 1997).

access to a source of stable monthly income largely in the form of welfare payments and pensions; and that for those with access to a source of stable monthly income, the value was low—and average of R$302. Data also indicate that all families have access to land (albeit varying areas). Data show that rural activities are important cash earning enterprises with all but two families selling rural products in Mutuacá. Results also indicate that the sale of açaí is the most important commercial activity, with the most families selling the product out of any other products. Based on observations of residents' activities, in a few years when recently planted açaí matures, the sale of the fruits will play an even greater role in providing cash income to local families. Second to açaí is the collection of freshwater shrimp, which seven families sell regularly. Finally results also indicate that rural products are marketed in a number of different ways. Açaí fruits are primarily sold by volume to middlemen who transport the fruits to Santana, finding additional buyers. Local residents on the other hand see their own shrimp, often through a labor intensive process that involves peddling shrimp for door to door in nearby upland communities. Fruit and annual crops from várzea fields are also sold locally—either within the community, within the Foz de Mazagão. In the case of fruit pulp, area schools in Mutuacá, Carvão, and the Foz de Mazagão are a dependable market. Timber is also sold locally using various marketing strategies. Owners of mills will also sell plywood in Santana, which fuels the growth of cities in the greater Macapá region.

Summary: Toward a Characterization of Economic Strategies in Mutuacá

Economic patterns in Mutuacá display a hybrid form. In the course of making a living, residents integrate income urban income—from the public and informal sectors into a rural-based livelihood system. Like informants in Carvão, Mutuacá residents expressed a

sense of fluidity between the urban and rural spheres of their lives, and also described the need to integrate various resources. Dona Isadora from Mutuacá explained, "we simply get by here…I cannot say that things are easy…I buy food each month [with money from the pension] and when it runs out, we fish, we hunt, and in the winter we buy more food. She explained that to keep her children going hungry, she will buy meat from the fluvial traders on credit..." She also explained that planting açaí provided her with a sense of relief that things would continue to improve, and that someday the açaízeiro would stop at her house and purchase hundreds of *reais* worth of fruit. Toward the end of our conversation she seemed to reconsider how she had conveyed life in Mutuacá, and told me that on second thought, things were not so bad…that "with money from fruit, and from shrimp and a little help here and there, we will always survive."

At the same time, however, in comparing residents' strategies across the communities, I have found urban and rural resources serve different purposes. Whereas urban income in Carvão stand in place of farm income, in Mutuacá, urban income is earned in addition to income from the sale of rural products (i.e. açaí and shrimp), and thus increases household economic security. In Mutuacá, I found that welfare payments and pension help to carry recent migrants through the transition period that follows their move and provides them with "breathing room" while they invest in their properties. In addition, these payments have allowed families to more easily transition from timber production to açaí production on their properties, as the money sustains them while açaí palms are growing. Finally, elderly residents say that the added income from their pension helps sustain families through the winter months—defraying additional food costs and preventing hunger during this time.

Based on these results, in Carvão, agricultural change can be characterized as community-wide shifts away from commercial production to subsistence production. In Mutuacá agricultural change can be understood as a process of specialization. Here families have shifted from maintaining various different land-use types on their properties at one time—to converting much of the land on their properties to açaí-dominated orchards. While a diversity of plants is still maintained within their home gardens, some crops are in short supply. In the past, residents recall that farmers maintained a system where they produced many annual crops, corn, sugarcane, banana, squash, maxixe, watermelon, and various others for sale in local markets, for their own consumption, and for feed to raise animals. Data from this dissertation indicate that few households are dedicated to these activities; while many had planted small agricultural fields, most admitted that the fields were simply a step in the conversion of land to açaízais. The movement away from subsistence forms of production coupled with rising income, which now circulated through the community on a regular basis has prompted shifts in consumption patterns, where like in Carvão, Mutuacá residents today purchase a larger percentage of their food.

Discussion and Conclusions

Comparing socio-economic changes in Carvão and Mutuacá

Over the past 15 years, both Carvão and Mutuacá have grown in population and spatial extent. Growth in Carvão is taking place at a faster rate an on a larger scale. The migration of poor residents to Carvão coupled with the emergence of a professional class has resulted in new economic hierarchies in the community. Social differentiation on the basis of income is largely non-existent in Mutuacá, where the expansion of the public

sector did not bring high paying jobs to the community. In both communities (due to social and political changes occurring since 1988) residents have greater opportunities to earn cash locally. Today, livelihoods display a hybrid form as residents integrate urban income—informal wages and government wages and payments—into a rural based livelihood system. However, due to differences in access to natural resources and shifts in local markets, which increased demand for várzea products but caused farinha prices to fall, urban income plays different roles in each community. In Carvão, urban income has replaced farm income, as farmers have lost markets for manioc, and subsequently downsized commercial production to subsistence production. In Mutuacá urban income is earned in addition to cash earned from the sale of açaí, shrimp, and other products; and changes in rural production can be characterized by a trend of increasing specialization of açaí to the exclusion of other crops (and vegetation types). In both communities increased cash circulation has prompted changes in consumption practices—where today families purchase more of the food that comes into the household. In Mutuacá, the poorer of the two communities on the basis of stable income values, the earning potential of açaí has left families more optimistic about the future. Carvão residents on the other hand are generally pessimistic about the local economic situation. The case of Mutuacá demonstrates that with good economic incentives farmers invest in agricultural production (even when earning pensions and welfare payments) and serves as an example of how rural production geared toward a growing urban market can generate income in rural community.

New considerations for the caboclo literature

The conclusions from these case studies make several contributions to the literature on Amazonian caboclos. In examining the ethnographic literature on Amazonian caboclos from the early works beginning with Charles Wagley's *Amazon Town* (1954) to the later works published after 1990, we observe a trend of increasing complexity in economic patterns. More recent studies focusing on economic patterns in caboclo conducted by Clearly (1993) and Nugent (1993) called attention to the importance of urban work and resources to peasants' livelihood systems. Studying in the greater Santarém region (state of Pará), Nugent described the caboclos economic system as "an extensive form of resource use embracing agriculture, terrestrial and riverine extraction, small-scale mercantile activities, wage labour and the production of goods and services in the urban setting" (Nugent 1993)." To obtain these resources, Cleary called attention to caboclos ability to work under various labor arrangements. In various regions of Amazonia, Cleary observed caboclos working for wages, as autonomous producers and under aviamento-type relationships. Results from economic studies in Carvão and Mutuacá allow us to conclude that in addition to resources outlined in Nugent's caboclo-complex, caboclos depend on government wages, various pensions, and welfare benefits to piece together a livelihood. We also observe that Carvão and Mutuacá residents work as informal wage laborers, government workers—and as farmers, residents engage various commercial relationships—selling products for cash, or exchanging rural goods for urban goods. Furthermore, because of new opportunities to earn cash from the public sector, caboclos in Carvão and Mutuacá today negotiate large government bureaucracies, which represents an entirely new form of labor evolving since 1988. Thus, the results from

Carvão and Mutuacá demonstrate that economic patterns in these modern-day communities are even more complex, and that with this complexity, residents take on new roles and work under different and within a diversity of situations.

At the same time, the pattern of livelihood complexity that I describe for Carvão and Mutuacá is somewhat different from the trends outlined by Nugent and Cleary. Both authors stress the importance of urban centers in providing caboclos with seasonal employment. In doing so, Clearly and Nugent also suggest a separation (albeit blurred) between the rural and urban spheres, where after working during the winter months, caboclos return to their communities and a rural-based livelihood activities (also see Harris (2000b) for a similar description of seasonal work patterns). Work patterns in Carvão and Mutuacá over the past 15 years have taken on a different form. In part due to residents' own efforts, opportunities to earn income in the interior have increased—such that today to access urban resources, resident no longer have to migrate. In short, due to changes occurring since the late 1980s, elements of the city exist now exist in the interior of Mazagão.

Moreover, in Chapter Five I argued that in examining the recent history of Carvão and Mutuacá we gain a different view of caboclos, one where residents have a sophisticated knowledge of political institutions and have tapped into local social movements to change their own position of marginality. Through resident's involvement in the rural workers union of Amapá, for example, caboclos from Carvão and Mutuacá have shifted their identity from clients in the system of aviamento to those of rural workers with rights within the society. Despite these wider changes however, finding

from fieldwork demonstrate that residents continue to employ patron-client relationships—seeking to form connections with more powerful individuals. In Carvão and Mutuacá, for instance, residents often designate a local patrão who might cover the expenses of family ceremonies (baptisms or graduations) or help out the family during times of need. The use of paternal relationships has been described in all ethnographies on caboclo societies as a strategy to increase economic security. The case of Carvão and Mutuacá is again subtly different. Here individuals acting in the role of the patrão are often members of the community themselves and of caboclo origins themselves, as opposed to belonging to the historical merchant class. This change is possible due to changes in the local social structure—where new class divisions have emerged in Carvão over the past 15 years.

As a way to conclude this discussion, I return to the question presented at the end of Chapter Four, which asked whether or not traditional aspects of natural resource management and economic strategies associated with the Amazonian caboclo were maintained in light of shifts toward more urban economic patterns? Based on the conclusions of this research, the simple answer to this question is yes. First, in examining the state of today's livelihoods we observe that traditional rural activities and technologies are maintained to varying degrees in Carvão and Mutuacá. Second, to take advantage of new urban resources to residents first had to acquire a working knowledge of urban institutions, bureaucratic procedures, local urban geography, and in some cases reinvented themselves as service providers and government workers, learning a whole new suite. These urban skills are used today conjunction with "traditional" technologies (of natural resource management) in the course of making a living. In this process of

learning new skills we gain a sense of residents' flexibility, capability, and sense of opportunism. These traits have long been associated with the Amazonian caboclo and have allowed caboclos to take advantage of all existing resources—both urban and rural in nature—to survive in the aftermath of Portuguese colonialism and to withstand the great economic and environmental dynamism of the region.

In closing, the case studies outlined in Chapters Six and Seven provide a much needed update to the caboclo literature. As other regions of Amazonia are impacted by macro-level processes—decentralization, social movements, market and demographic shifts—caboclo societies and other peasant groups will be presented with some challenges and opportunities presented in these case studies. As this study demonstrates, the effects of external socio-economic forces on local economic strategies are complex and contingent on a variety of factors. In the case of Carvão, differences in ecology have been particularly important in shaping current economic opportunities. These case studies are useful in examining how smallholders respond to wider social and economic change—actions that have implications for natural resource management and local patterns of biodiversity.

CHAPTER EIGHT: Dissertation Conclusion

Introduction

Over the past fifteen years, the Carvão and Mutuacá region has been influenced by various changes—government restructuring, social movements, urbanization and change in markets. On a broad level, these changes have prompted residents to modify their economic strategies and agricultural practices. Changes in land use are visible in the landscape surrounding both communities. In Carvão, old agricultural areas are returning to forest, as famers downsize production on their properties. In Mutuacá, residents are increasing the production of açaí throughout their properties and thereby modifying the structure and composition of várzea forests. In some cases, residents are restoring previously cleared or exploited lands; and in others, they are managing native forests for the growth of the açaí palm. Observed livelihood changes occur within a long history of economic change in the region, as residents have time and again modified production to meet new market demands for various plant products. The economic history of the study site reveals the adaptability, flexibility and endurance of caboclos in the region; perhaps most importantly, the regional history illustrates the resilience of the landscape—its ability to recover from repeated cycles of resource extraction and to continually provide residents with a diversified natural resource base from which to survive.

Summary of Research Findings I: State of Agriculture and Agrobiodiversity

The findings from this dissertation indicate that Carvão and Mutuacá farmers both maintain diverse land use types on their landholdings as well as variation in their farming practices. Despite broad changes occurring in the communities, agricultural practices remain largely traditional in practice. Even residents with greater access to cash income

do not largely modify their techniques (i.e. invest in pesticides, irrigation or other technologies). At the same time, however, low-cost technologies that yield results such as, the alteration of cropping patterns are incorporated by farmers. Furthermore, in both communities areas of annual cropping have been greatly reduced. In Carvão, 44 out of 80 residents interviewed were found to maintain at least 0.2 ha in annual cropping; however the average field size has declined by 50% in ten years. In 15 fields, 14 manioc varieties were documented, a level consistent with findings from studies on patterns of intra-specific diversity of manioc in caboclo communities across Amazonia (Empeiraire 2002). In Mutuacá, annual crop fields (*roçados*), typically planted with diverse crops, have disappeared from the community. Instead, a small number of farmers (4 out of 17) maintain monocultures of corn planted as a step in the process of preparing and açaízal.

On the other hand, results show that home gardens in both communities are rich in cultivated plant species. A total of 90 species was recorded in 14 home gardens in Mutuacá, while 116 species were recorded in 18 home gardens in Carvão. Levels of plant species richness in home gardens in the study area are much higher than levels recorded by researchers studying agrobiodiversity in the same municipality (Pinedo-Vasquez et al. 2002). Diversity in home gardens is explained by farmers' desire to have access to economic plants within the vicinity of their homes. This desire thus leads farmers to obtain planting materials from a variety of sources and manage the garden to optimize diversity. In Carvão, where livelihoods have become increasingly urban in nature, farmers continue to experiment with agricultural production in home gardens and thereby connect with their rural roots. For Carvão farmers, the home garden is an easier space to manage in the dry terra firme. In the vicinity of their homes, farmers have access to water

and can easily improve the weathered soils to cultivate a greater variety of plants. In Mutuacá, the cultivated plant diversity in home gardens is in part attributed to the cultivation of annual crops, which were once planted in roçados.

Summary of Arguments: State of Agriculture and Agrobiodiversity

Based on an analysis of results, this dissertation argues the following. In despite the predictions of plant scientists that the reduction in total farm area leads to the erosion of agrobiodiversity (Cleveland et al. 1994, Ban and Coomes 2005), in Carvão, farmers maintain high levels of manioc varietal diversity in shrinking areas. In line with previous research on change in smallholder communities, market integration and specialization in Mutuacá has coincided with the disappearance of subsistence farming in annual crop fields (Humphries 1993, Henrich 1997, Peroni and Hanazak 2002). At the same time, however, many of the crops previously planted in roçados are conserved by farmers in home gardens. In both communities, farmers maintain high levels of cultivated plant diversity in home gardens despite broad change in economic strategies. These findings support the observation that overall farm size (i.e. total area under production) is not always correlated with agrobiodiversity (Brush et al. 1992); researchers argue that this simple relationship is complicated because agrobiodiversity is influenced by farmers' intervention and management. In summary, results from this dissertation support findings of plant scientists who argue that in spite of rapid change in smallholder societies across the globe agrobiodiversity is surprisingly resilient (Brookfield et al. 2002, Brush 2004). Because of the importance to cultivated plant diversity to residents' subsistence patterns, farmers in the study area will likely continue to seek out seed materials from within and beyond their communities to plant in home gardens.

Summary of Research Findings II: Change in Caboclo Economic Strategies and Social Patterns

Research on past and previous economic and social patterns yielded several important findings. Oral histories indicate that residents have continuously shifted economic activities. From the early 1900s to the 1950s, residents have engaged in the commercial extraction of diverse plant resources. Later they extracted timber first for international export and later to supply local markets. Since the 1970s, many residents have engaged in the production of manioc in the terra firme of Carvão, producing for local urban markets. Furthermore, oral histories from the study site show that despite residents' inferior social position within the larger society as caboclos, and as African-descended peoples, throughout history residents have displayed an active sense of agency. The participation in subsistence activities, and thus being able to secure food for their families, has in part allowed residents to what degree they want to engage in market-oriented activities. Moreover, since the 1970s, residents have used direct forms of social activism and political organization to improve their socio-economic position within the regional society.

Results from current household economic surveys reveal that residents in the study area maintain a hybrid livelihood structure. Residents integrate urban income in the form of wages, pensions, and welfare payments with age-old rural activities. Thus, caboclos in Carvão and Mutuacá today rely on both a detailed knowledge of natural resource management and have an in-depth understanding of urban geography, institutions, and bureaucracies. Comparing the two communities, livelihoods in Mutuacá are more rural in nature. Research results show that differences between stable income

levels, household size and size of landholdings, were significant between the two communities. In Carvão where livelihood patterns are more urban, the mean level of stable income is higher. On the other hand, the mean landholding size was lower. In Carvão, four types of families based on the degree to which families rely on rural activities were identified. Research results show that the most rural families had lived in Carvão for the fewest number of years. As we might expect, families with more engaged more often in rural activities. Finally, demographic changes in the region, coupled with increased opportunities to earn cash income, has forged new social divisions in Carvão on the basis of access to land and income. Income stratification is seen in the practice of "wealthier" residents employing poorer residents to work as maids, babysitters and general laborers. Finally, the practices of land borrowing/lending are both evidence of land inequities and the community's attempt to reconcile the uneven distribution of resources.

Summary of Arguments II: Change in Caboclo Economic Strategies and Social Patterns

This dissertation makes the following contributions to the ethnographic literature on caboclos in Amazonia. While previous researchers have argued that since the 1970s caboclo livelihoods have become increasingly complex, as rural peoples migrate to incorporate seasonal urban labor and service into their household economic portfolios, the patterns observed in Carvão and Mutuacá are different in the following way. In part through their own efforts, urban opportunities have become available to residents in the countryside. Thus, residents do not need to migrate to engage in urban work and earn urban income. In addition, despite the observed social and economic change occurring in

the region—namely the trend towards a more urban-based livelihood system these transitions can be viewed as a historical continuity. To garner new urban resources, residents have relied upon characteristic traits of the Amazonian caboclo—flexibility, opportunism, and innovation that have long allowed residents to survive in the face of environmental and economic uncertainty.

Broader Impacts: Conservation and Development in Amazonia

Conservation and biodiversity

In spite of broad socio-economic change, high levels of agrobiodiversity (and thus crop genetic resources) are maintained in Carvão and Mutuacá albeit in shrinking fields and small home gardens. On a landscape level, old agricultural areas in Carvão are returning to forests—a land use type characterized by higher levels of plant diversity. At the same time, however, patterns of urbanization could undermine these short-term gains in Carvão.

In Mutuacá, the long term effects of açaí intensification on biodiversity in the landscape merits further investigation. From previous research we know that forests managed for açaí, as well as areas newly planted with açaí, are characterized by lower plant diversity and a high dominance of açaí (Brondizio 1996, Brondizio and Siqueira 1997). Yet, we do not know if and how vegetation changes impact the provision of ecological services in the landscape. Research in Mutuacá indicates that families maintain relatively small areas in intensive açaí production. Research on açaí production in the estuary indicates that relatively small managed areas provide families with adequate economic benefits (Anderson and Ioris 1992, Peters 1992). From these insights we can conclude that as long as farmers maintain a diversified landscape, açaí production is a

means to a sustainable livelihood for várzea farmers. In either case, the biodiversity maintained on residents' properties depends, not on future land use by smallholders, but on large-scale development patterns in the region. Given its close proximity to the capital, the Mazagão region, is considered prime for development. In recent years, for instance, the state government has been working to bring soybean plantation agriculture—largely regarded as an unsustainable land use—activity to the areas of savanna in and around the capital. Research from this dissertation indicates that most farmers do not have legal claim to their lands, and thus little staying power in the face of development pressures—suggesting that the biodiversity maintained by smallholders in the Carvão and Mutuacá region is at risk.

Local livelihoods and rural economic development

At the end of Chapter Seven, I described differences between residents' attitudes concerning the current and future state of the local economy. In Mutuacá, where fewer families earn income on a monthly basis, in general residents felt optimistic about the future. Most were investing in açaí and were thus hopeful that life would improve once their plants became productive. In Carvão, on the other hand, residents felt pessimistic about the future. For Carvão residents, farming is no longer economically viable and government jobs and income are in short supply. Thus, the case of Mutuacá demonstrates the importance of strong local markets in providing rural families with economic benefits. These insights are of immediate benefit to producers in Carvão. Research indicates that even though prices for farinha have fallen, there are local unmet demands for fresh fruits, herbs, and vegetables—all of which can be easily grown in home gardens. In addition, demand for locally raised poultry is also growing in nearby cities. Both

activities require little financial investment and could help spur needed local economic growth to benefit families in Carvão.

In summary, this dissertation presented detailed case studies from two small communities in the Amazon estuary. While some of the processes are specific to these locations, many observations are applicable elsewhere as rural agrarian societies across the globe are impacted by globalization and urbanization processes. In particular, hybrid, diverse livelihoods where residents merge age-old rural activities with forms of urban work in new and interesting ways are becoming more and more common in rural societies. Insights from this dissertation, both on how residents responded to these changes and their impacts on biodiversity and livelihoods, can thus help us manage these effects in Amazonia and beyond.

Appendix 3.1: Botanical Description of Manioc (*Manihot esculenta* Cranz)

Background

The manioc plant (cassava) is one of 100 species in the *Manihot* genus of the Euphorbiaceae family and is widely cultivated for its starchy roots, ranked as the 6th most important source of calories on in the human diet (Alves 2002). *Manihot esculenta* is the only cultivated species of its genera. Across the globe, cassava is consumed in two main forms—the bitter and the sweet varieties. The bitter varieties contain more than 100 ppm of cyanogenic glucosides and the sweet varieties have less than 100 ppm of these compounds (cg are found in all parts of the plant except the seeds). The roots of the sweet varieties are safe for human consumption and thus the edible roots are boiled and eaten in their natural form. The bitter varieties entail the removal of these compounds, through a laborious process, and are eaten in the form of coarse flour, tapioca (a popcorn-like food), and flatbreads (*beiju*). Manioc is considered an ancient crop, whose domestication began 5000 to 7000 years ago in Amazonia, according to archaeological evidence in the Amazon (Alves 2002).

Description

Despite its global importance and long history of use, links between the cultivated species and its wild progenitor were only recently elucidated. In March 1982, a population of wild manioc indistinguishable on the basis of morphology was identified in the Brazilian state of Goias. This discovery led to the public announcement that cassava grows in the wild (Elias et al. 2004) and led to the establishment of three subspecies (*Manihot esculenta* Cranz ssp *flabellifolia* (Pohl) Cifferi*, Manihot escultenta* ssp. *peruviana*

(Mueller) Allen. While many theories regarding the domestication of manioc exist, today most crop scientists theorize that cassava was first domesticated from *Manihot esculenta* Cranz ssp *flabellifolia*, it wild bitter progenitors, and then later sweeter forms evolved as a result of selection for low cyanide content (Alves 2002).

Manihot esculenta Cranz is a perennial, monoecious shrub with a woody, cylindrical stem formed by alternating nodes and internodes. The main stem branches two, three, or four times and produces secondary branches and other successive branches. The leaves are simple, alternate, with palmate venation, and crowned with two stipules. The leaves are lobed with an uneven number of lobes, ranging from three to nine (only a few varieties have three lobes and are thought to represent a primitive ancestral character). The inflorescence is formed at the insertion point of the reproductive branching; to prevent self-fertilization, the female flowers open before the male flowers (progyny); the individual flowers do not have a distinct calyx and corolla, but rather have five red or purple tepals, ten stamens, and a ten-lobed basal disk. A small style sits on top of the ovary; the stigma has three undulated, fleshy lobes. The fruits are trilocular capsules, ovoid to globular, and measure 1-1.5 cm in diameters with longitudinal ridges. The fruit matures in 75-90 days after pollination; the seeds are ovoid, ellipsoidal with smooth, dark brown to grey coats and are dispersed through autochory (explosive dehiscence) and by ants (Alves 2002).

The roots of manioc are the main storage organ of the plant and also the economically important organ of the plant. Root size and shape can vary greatly between the varieties and with environmental conditions. Plants propagated from seed form a tap root, from which many adventitious roots develop. Later the taproot and some of the

adventitious roots become storage roots. When plants are propagated from stem pieces (the case of most plants in agricultural fields) adventitious roots develop from the stem and later form a fibrous root system; the mature cassava storage unit has three main areas: bark (periderm), peel (or cortex) and parenchyma, which is the edible portion of the root and accounts for 85% of the total weight. Coloration of the bark, peel, and parenchyma varies; in the latter case, commercialized varieties of manioc are often white, to cream, to yellow in color. The roots are highly perishable and have the shortest post-harvest life of any of the major root crops; roots become inedible within 24-72 hours after harvest due to a rapid physiological deterioration due to the production of phenolic compounds (Alves 2002).

Appendix 3.2: Growing Plants in the *Roçado*: Plant Health and Disease in Caboclo Agricultural Systems

Caboclo farmers in Mutuacá explain the successful cultivation of crops in the várzea one lies in controlling the microenvironment around the plant, and maintaining the proper balance between temperature and humidity. In practice, this means that farmers time the cultivation of a particular plant species in the *roçado* with seasonal rains and the annual flood regime. For instance, corn and beans are planted at the end of the dry season and harvested before flood waters threaten to drawn the plants. In addition, only a few plants, such as rice (*Oriza* sp.) and various palm species, such as açaí (*Euterpe oleracea*) can tolerate the waterlogged soils of the lower areas of the várzea (which is why farmers place their roçados on higher areas of land).

Following caboclos' ideas of plant health, farmers in Mutuacá have an understanding of the growth needs of different species (and varieties) and the environmental conditions that favor its growth. For instance, açaí is considered a plant of the rain and is cultivated throughout farmers' properties beginning in March when the heavy rains begin. Bananas, on the other hand, are described as plants that dislike water, and are planted during the dry season. Farmers explain that bananas fare best on areas of high land, and thus farmers plant bananas throughout their properties, usually along igarapés and riverbanks, but also on areas of higher land scattered throughout the forests.

Through my conversations with farmers, I found that caboclos understandings of plant health and disease are similar to their ideas of human health. Caboclos in the eastern Amazon generally believe that abrupt changes in temperature lead to changes in blood

and eventually sickness and disease in humans (Reeve 2000). They also believe that exposure to astral bodies, such as long exposure to the sun and to the full moon can spur internal blood and organ damage and eventual disease in humans. Farmers in Mutuacá and Carvão often told me that exposing a plant to abrupt temperature changes—such as allowing the roots of a plant to remain in soggy, cold soils while being exposed to heat of the sun—leads to fevers in the plant and eventual death. In addition, farmers do not plant fields under the full moon. Various farmers explained that planting corn under the full moon results in spilt kernels in mature fruits.

Moreover, banana plants of commercial value (of the "banana prata" variety) have in recent years become victims of the Moko disease, or infection by the bacterium *Ralstonia solanacearum* (E. F. Smith) Yabuuchi (formerly *Pseudomonas solanacearum*) (Roberts 2005). The disease causes wilting of the tissues, discoloration of the leaves, and eventual death. Farmers in Carvão and Mutuacá believe that the key to curing the plants of this "fever" is to control its internal temperature by planting bananas of this variety in the shade. Farmers now largely plant "banana prata" in fallows, where banana plants remain productive for three years before becoming victims to the Moko disease.

Appendix 3.3: ANOVA Test Results: Mean Number of Plant Species in Home Gardens

Anova: Single Factor, Number of Species Home Gardens

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Carvão	18	598	33.22222	92.77124
Mutuacá	14	320	22.85714	88.74725

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	846.0496	1	846.0496	9.294438	0.004767	4.170877
Within Groups	2730.825	30	91.02751			
Total	3576.875	31				

Appendix 6.1: ANOVA Test Results: Natural Resource Management Groups and Socio-Economic Variables

1. Anova: Single Factor-
Household size (# of people/residence)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Resource management type 1	14	80	5.714286	3.450549
Resource management type 2	32	155	4.84375	4.200605
Resource management type 3	20	113	5.65	6.134211
Resource management type 4	14	50	3.571429	1.956044

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	44.89554	3	14.96518	3.58725	0.017493	2.724944
Within Groups	317.0545	76	4.171769			
Total	361.95	79				

2. Anova: Single Factor, Residency (# of years living in Carvão)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Resource management type 1	14	234.2	16.72857	118.4776
Resource management type 2	32	546	17.0625	163.6734
Resource management type 3	20	156	7.8	66.35263
Resource management type 4	14	229	16.35714	399.0165

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1225.404	3	408.468	2.376633	0.076522	2.724944
Within Groups	13062	76	171.8684			
Total	14287.4	79				

3. Anova: Single Factor, Income (R$)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Resource management type 1	14	6430	459.2857	281176.4
Resource management type 2	32	15335	479.2188	426519.5
Resource management type 3	20	3225	161.25	108978.6
Resource management type 4	14	6700	478.5714	539794

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1475285	3	491761.7	1.439378	0.237946	2.724944
Within Groups	25965314	76	341648.9			
Total	27440599	79				

4.Anova: Single Factor, Landholding size (HA)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Resource management type 1	14	562.5	40.17857	1287.139
Resource management type2	32	454.5	14.20313	463.0622
Resource management type3	20	77	3.85	225.9237

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	11218.34	2	5609.169	9.987982	0.000171	3.142809
Within Groups	35380.28	63	561.5918			
Total	46598.62	65				

Appendix 7.1: ANOVA Test Results: Socio-Economic Variables (Carvão and Mutuacá)

1. Anova: Single Factor, Income ($R)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Monthly Income, Carvão	51	31690	621.3725	406050.1
Monthly Income, Mutuacá	13	3930	302.3077	28719.23

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1054609	1	1054609	3.16682	0.08005	3.995887
Within Groups	20647135	62	333018.3			
Total	21701744	63				

2. Anova: Single Factor, Residency

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Residency, Carvão	80	1165.2	14.565	180.8532
Residency, Mutuacá	17	205	12.05882	83.05882

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	88.06239	1	88.06239	0.535716	0.466015	3.941221
Within Groups	15616.34	95	164.3826			
Total	15704.41	96				

3. Anova: Single Factor, Landholdings (HA)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Landholdings (ha), Carvão	38	1127	29.65789	875.596
Landholdings (ha), Mutuacá	12	588.25	49.02083	1776.051

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3419.301	1	3419.301	3.160313	0.081784	4.042652
Within Groups	51933.61	48	1081.95			
Total	55352.91	49				

4. Anova: Single Factor, Household Size (# of people/residence)

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Household Size, Carvão	80	398	4.975	4.581646
Household Size, Mutuacá	17	121	7.117647	7.235294

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	64.36777	1	64.36777	12.8004	0.000548	3.941221
Within Groups	477.7147	95	5.028576			
Total	542.0825	96				

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